BRAZING BOILERS
L.B.S.C.

THE MODEL ENGINEER

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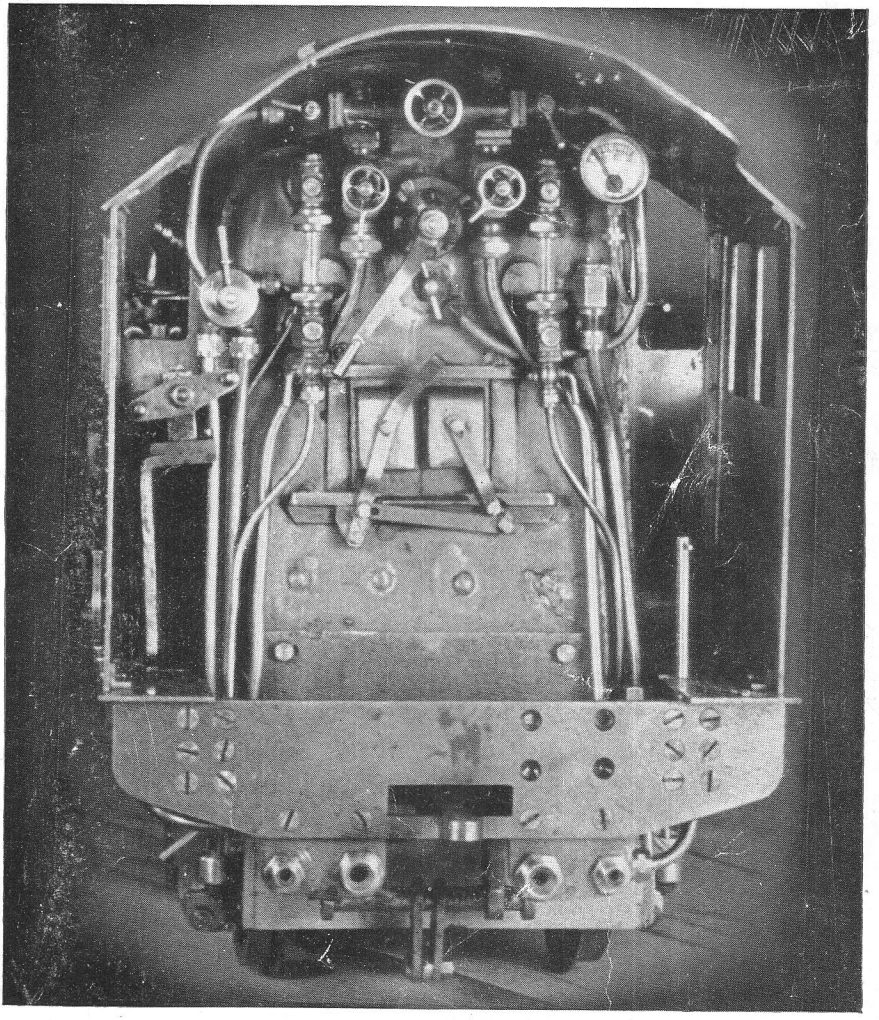

A Well-Laid-Out Cab!

The backhead of Mr. N. E. Nicholson's ¾-in. scale "Princess Royal" is typical of the workmanship which earned him the premier awards at this year's Sheffield S.M.E. Exhibition

THE
MODEL ENGINEER
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SMOKE RINGS

"Exhibit A"

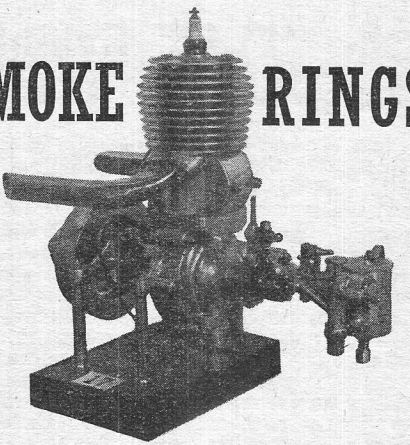
ONE of my correspondents who sends me some practical suggestions regarding improved planning of the next MODEL ENGINEER Exhibition includes one idea on which my modesty prevents my making any comment. He proposes that I should be seated in a glass enclosure in the centre of the Exhibition so that my many friends could at least get a glimpse of me even if they could not get near enough to shake hands and exchange a greeting. "Exhibit A" as they say in the law courts.

The Ken View Model Railway

THIS interesting model railway, under the enterprising supervision of its owner, Mr. A. G. Beach, has been moved to new quarters at 27, Broadway Parade, Crouch End, London, N.8. Since its re-opening in March last 17,000 visitors have been to see it, and I am sure its main objects of stimulating interest in model railways and of collecting funds for local hospitals and other charities are being fully served. It is open to view daily from 11 a.m. to 9 p.m.

A Model Maker and Poet

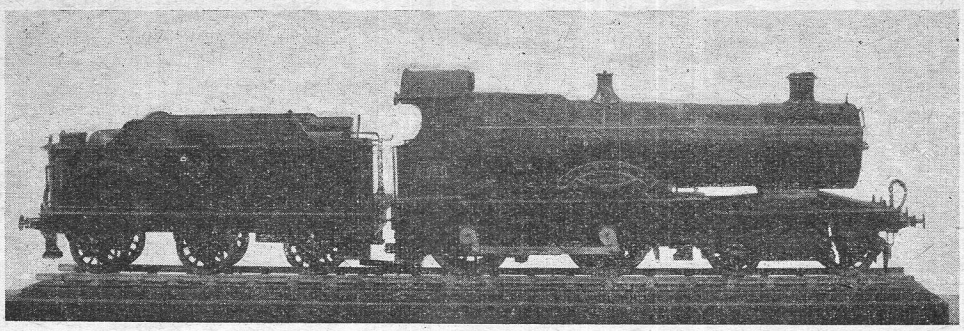
I KNOW of many model makers who are also musicians and of some who are also artists, but it has lately been revealed to me that there is one who between his workshop hours takes up his pen to become a poet. I refer to Mr. W. Edward Maddock, the head of a well-known Burslem pottery firm, who, among his many model engineering friends, is affectionately termed "The Professor." I imagine this academic title arises from his broad outlook on the human problems of life and his vast store of general knowledge accumulated through his wide personal contacts, his diversified reading, and the impressions gathered from many thousands of miles of foreign travel. Busy though his life has been, he has found moments of quiet reflection in which to commit to paper his thoughts in verse on many things—love, nature, dreams, ambition, friendship, and the hundred and one facets of imagination which have sparkled like diamonds in his poetic mind. The result of these pleasurable activities is to be found in a charmingly produced volume entitled "Poems, Sketches, and Epigrams," an autographed presentation copy of which will find an honoured place on my bookshelf. Professor, potter, poet and popular personality is surely an unusual combination among model engineers. I congratulate Mr. Maddock on his unique distinction.



MiniatureLocomotives Televised

AN interesting television display was given on Saturday, October 5th, 1946, when Mr. W. J. Bassett-Lowke introduced the programme dealing with Model Railways. Mr. Bassett-Lowke gave a short talk on the historical development of model railways, illustrated by models of 1900, 1910, and 1935, and introduced Mr. Pinnock, the Chairman of the Society of Model and Experimental Engineers. The cup-winning model locomotive at the recent MODEL ENGINEER Exhibition was exhibited by its owner, Mr. S. T. Harris, who explained details of its design and construction. Chassis of engines under construction by members of the Society of Model and Experimental Engineers were explained by Mr. Pinnock to indicate the nature of the work involved. Two "OO"-gauge locomotives, made by Mr. Sherwood, of the Kent M.E.S., and steam-driven, were also displayed, and the following were shown under steam and hauling loads on the S.M.E.E. track:—"O"-gauge Stroudley tank engine by Mr. Bennett (S.M.E.E.); 2½-in. gauge 4-4-0 by Mr. Nicholls (N.L.S.M.E.), 3-in. gauge Midland 4-4-0 by Mr. Baird (N.L.S.M.E.), and 5-in. gauge 0-6-0 locomotive built by the Society of Model and Experimental Engineers, and driven by Messrs. Hart and Maxwell. From such reports as have come to hand, it seems that transmission was excellent, and all concerned had an extremely interesting and unusual experience.

Percival Marshall



7-mm. scale steam-driven G.W.R. "Bulldog"-type engine, by A. H. Drewry

LOCOMOTIVE MODELS

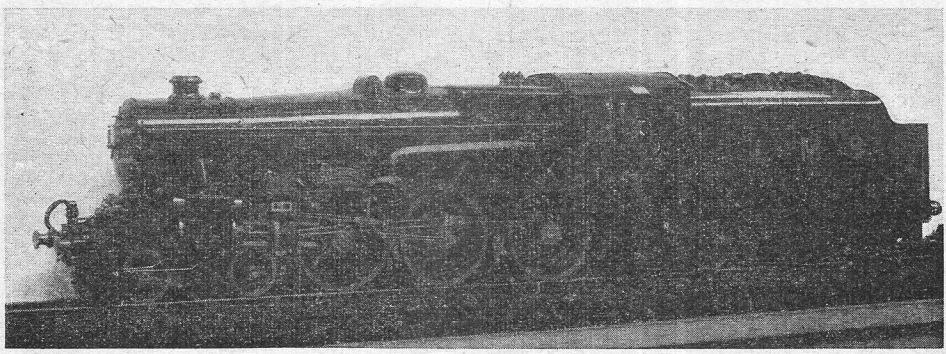
at the "M.E." Exhibition

By J. N. Maskelyne, A.I.Loco.E.

THERE was certainly no lack of variety in the locomotive models at THE MODEL ENGINEER Exhibition; neither was their number below the average to which we had become accustomed before the war. But more important and, to some extent, more surprising was the fact that the standard of workmanship was consistently high, and it was almost impossible for the judges to assess, at a glance, which exhibit was really better than its neighbours; each one had to be most carefully scrutinised and judged entirely on its merits.

Paper rationing will not permit of any extended critical survey of the exhibits; therefore, these notes must, perforce, deal only with a few of the more interesting entries in the competition section. Taking them in Catalogue order, the first, appropriately enough, is Entry No. 1, a 1-in. scale, free-lance, 4-cylinder 4-6-0 engine and tender by Mr. S. T. Harris, of Dollis Hill. In general proportions and outline, this engine very closely followed the L.M.S. Class "5XP" express. passenger design; but it was equipped with four cylinders instead of three, and departed from its prototype in some other minor details. The workmanship put into its construction was most excellent, and the amount of accurate detail included in it was, even for 1-in. scale, unusual. All the more extraordinary, therefore, was the fact that there were one or two very minor features on it which betrayed a lack of knowledge—or, perhaps, appreciation is the better word—of locomotive engineering. The chimney was too small in diameter to be really efficient, and it was surmounted by a cap of which the shape showed plainly that Mr. Harris is unaware of the reason why locomotive chimneys, other than stovepipes, are flared. But, in spite of such small blemishes, this very fine exhibit scored so high a total of marks that it won the Locomotive Cup and 1st Prize.

Entry No. 33 deserves mention on account of its unusual nature. It was a 10-mm. scale reproduction of an Aveling & Porter Tramway-type locomotive as used by the Thames Conservancy Catchment Board; it was made by Mr. J. F. Bruton, of London, S.W.6, and its one peculiarity, which caused quite a lot discussion, was that the



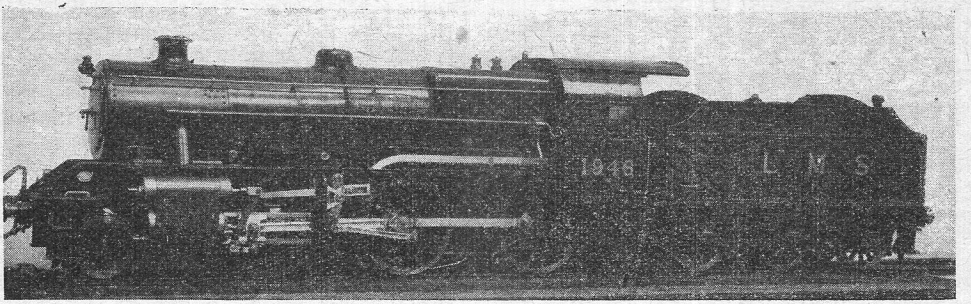
The winner of the Locomotive Cup

flanges of the wheels were outside instead of inside the rails.

Entry No. 63 was the fine ¾-in. scale L.M.S.R. "Princess" class 4-6-2 engine named *Percival Marshall*, built by Mr. G. R. Hill, of Brechin. This excellent piece of work was quite a faithful replica of its prototype and embodied a great deal of accurate detail. It was awarded a V.H.C. Diploma.

Entry No. 225 was another interesting exhibit, in that it was the work of a competitor aged 73. It was a 4¾-in. gauge 4-6-0 locomotive based on the Southern Railway's "Lord Nelson" class. It had a plain cylindrical boiler, however, and only two cylinders instead of four; but the general workmanship and finish were good. This exhibit won a "C" Diploma.

Entry No. 251 was another "Lord Nelson,"



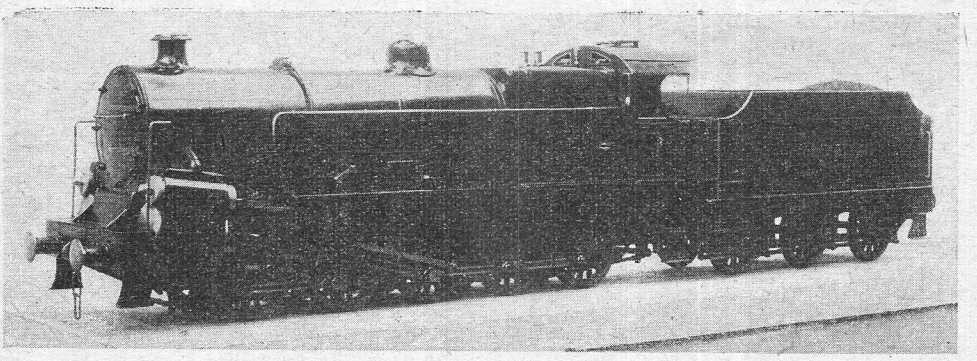
D. M. Picknell's 3½-in. gauge L.M.S. 2-6-0

Entry No. 88 was a 3½-in. gauge L.M.S.R. 2-6-0 mixed-traffic engine built by Mr. D. M. Picknell, of Birmingham. The builder had taken L.B.S.C.'s "Princess Marina" as the basis, but had made certain modifications and additions to the external details in accordance with a photograph of the full-size prototype and produced a splendid job which was awarded 2nd Prize.

Entry No. 182 was decidedly interesting. It was the work of Mr. D. B. Gloyns, of Hayes, Middlesex, who, although strictly following pre-grouping L.S.W.R. practice, had succeeded in producing something original. The engine was to 1-in. scale and consisted of a 4-4-0 chassis which was an almost exact reproduction of the celebrated 7-ft. 4-4-0 of William Adams's 1892 design; the boiler, however, belonged to a much later date and was based on R. W. Urie's designs. The result was an engine that might have come into existence if Mr. Urie had decided to rebuild the Adams engine. The workmanship and general finish were excellent, and the exhibit was awarded a V.H.C. Diploma.

but, this time, for 3½-in. gauge; it was made by Mr. C. R. Fox, of Wembley. In general outline, it was a good representation of the prototype, but, like the previous entry, was only a 2-cylinder instead of a 4-cylinder engine. The finish was of a very high order, even if, in some of the detail-work, the engine left something to be desired. It deserved its "H.C." Diploma.

All the foregoing were sub-classified as "Finished Models"; a number of "Unfinished Models, Chassis and Assemblies" were also entered for the competition, and some very nice work was to be found among them. Entry No. 131 was a chassis for a 2½-in. gauge S.R. "Lord Nelson" class engine; it embodied a wealth of carefully-made and very accurate detail, revealing that its builder, Mr. L. G. Warner, of Hendon, was not only an enthusiast for true-to-scale work, but a skilled craftsman of the highest class. The general arrangement followed the prototype exactly, including the 135-degree setting of the cranks, and, in spite of the small scale, this exhibit clearly showed that when the whole loco-



Seen on the passenger-carrying track; a fine ¾-in. scale L.M.S. 0-10-0 banking-engine

motive is finished it will be an outstanding example of its kind. It was awarded 2nd Prize in its class.

Entry No. 162 was a chassis for a 5-in. gauge 0-6-0 tank locomotive based on the "Pioneer" designed by the late G. S. Willoughby. Mr. G. C. Smith, of Kingston, the builder of this particular example, had made one or two slight modifications, and his workmanship was excellent, especially in view of the fact that, professionally, he is in no way connected with engineering. His exhibit won him an "H.C." Diploma.

Entry No. 187 was the work of a scientific instrument maker, Mr. J. S. Godman, of St. Albans; and a very fine piece of work it was! It was a well-finished chassis for a 4-6-2 locomotive and tender based on a design by Joslin. All the intricate details had been most carefully made and very well finished, and the award of 1st Prize was fully merited.

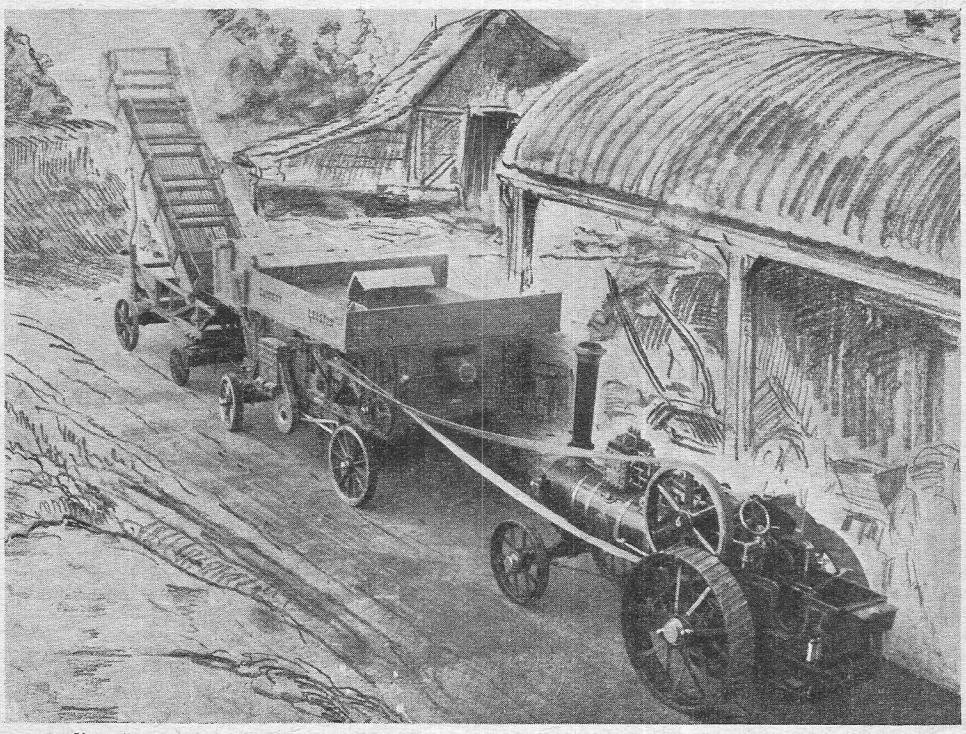
Entry No. 216 was just a little out of the ordinary in being a chassis, to 1-in. scale, for a South African 4-8-2 type locomotive. The work was not in a very advanced stage, but what there was of it was a great credit to Mr. D. A. Whiteside, of Carshalton. When it is fully completed this model will be, like its magnificent prototype, one of the largest locomotives for its gauge, and its chassis certainly deserved the "V.H.C." Diploma awarded to it.

Entry No. 223 was a nearly-finished 2½-in. gauge 4-8-2 "Ursa Maximus" to the well-known design by Joslin. It was built by Mr. C. A. Adams, of Hornsey, who had made most of the superstructure out of brass, but had followed more orthodox practice in the chassis and running-gear. The plate-work was particularly good, and all small screws, rivets, etc., were home-made. It deserved nothing less than the V.H.C. Diploma it gained.

Entry No. 230 was a 3½-in. gauge "Marina" 2-6-0 locomotive of more than ordinary interest in that it was the work of a lady, Mrs. M. A. Austen-Walton, of Worthing. This exhibit displayed most excellent craftsmanship and finish, as well as no little knowledge of locomotive details; it fully merited the award of the Bacon Cup.

Among models for "O"-gauge, was one which deserves mention here. It was a 7-mm. scale G.W.R. "Bulldog" class 4-4-0 which, at first glance, looked like one of the very fine electrically-driven miniatures to which we have become accustomed. Closer inspection revealed that it was a *steam* job, however; it was, of course, very simple in its working parts, but the representation was good. Mr. A. H. Drewry, of Hersham, deserved the "V.H.C." Diploma which his little engine gained.

"DOWN ON THE FARM"

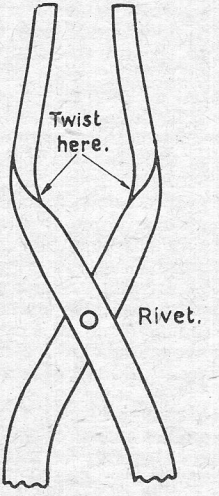


A realistic impression obtained by drawing on the photograph of Mr. F. G. Bettle's 1½-in. scale model threshing outfit, seen at the recent "M.E." Exhibition

"L.B.S.C's." "Hielan' Lassie"

How to braze the throat-plate joints

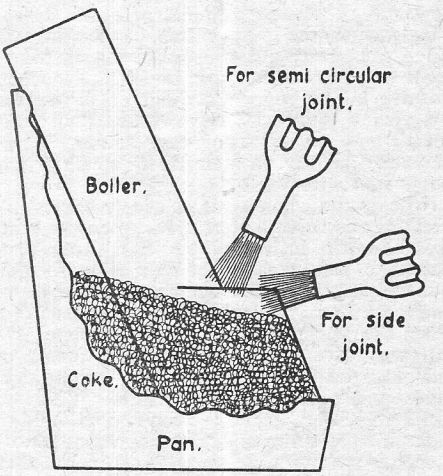
JUDGING from the number of requests I have received, to deal with the boiler-brazing in detail, a number of new readers seem to be scared stiff of the job, and several have asked for the name of a firm to whom it could be confidently entrusted. May I assure all and sundry that there is nothing whatever to be afraid of, as it is just a question of knowing how—your humble servant will do his best to look after that part of the business!—and with the necessary implements, plus a modicum of confidence and patience, even a raw recruit can make a quite satisfactory showing. I shouldn't advocate farming out the work, except as a last resource, when the requirements are not available. There are far too many "here-today-and-gone-tomorrow" merchants who cheerfully undertake boilersmithing, and land the unfortunate person who responds to their blandishments, with a lump of burnt metal containing more Welsh vegetables than could be found in any county of that delightful corner of Great Britain. I've just read a fine tale of woe from somebody down in Kent who was "caught"; 'nuff said. If you *do* happen to spoil a little copper, which is very unlikely, you can at least write it off as experience bought and paid for; but if somebody else spoils it for you, and you have to pay them as well, it's a double loss with "no return." I have described boiler-brazing in detail before, but for new readers' benefit will briefly repeat the instructions for the throat-plate joint; and all the rest of the joints being done in a manner somewhat similar, it will then be only necessary to call attention to differences where they exist.



Tongs made in five minutes

Materials Required

A pan is needed, which should be a little longer than the boiler, so that same may lie down in it. My present one is bent up out of 16-gauge steel sheet, the front edge being about 3-in. deep and the back about 10-in. high A discarded tea-tray does very well, with a bit of sheet iron bent channel-shaped to form back and sides, to hold a bed of small coke or blacksmith's breeze. Asbestos cubes are sometimes used, but coke or breeze is far more satisfactory, as it catches alight and helps the job along, by not only retaining the heat of the blowlamp, but adding to it. The lamp itself shouldn't be less than the five-pint size, for a boiler like the "Lassie's"; an equivalent air-gas blowpipe, operated by a fan or foot-bellows, may also be used. You'll want a big pair of blacksmith's tongs, to handle the boiler when hot; and a small pair (which you can make yourself from a couple of feet of $\frac{3}{8}$-in. by $\frac{1}{8}$-in. black steel strip and a $\frac{1}{8}$-in. rivet) to hold short lengths of brazing strip or silver-solder. A piece of $\frac{1}{8}$-in. iron wire about 2 ft. long, with a ring at one end and a point at the other, does for a scratch-wire. Materials needed are, a supply of easy-running brazing strip, and some silver-solder, both coarse and fine grades. For the former, the brand known as "Lafitte" is the best I used in the days before I took to oxy-acetylene and "Sifbronze." The latter need is best supplied by Johnson-Matthey's "B6" alloy, and "Easyflo." Where these brands are not available, use the best you can get in your locality. As for fluxes, for any kind of easy-running strip, or for use with brass wire when brazing iron and steel, I have found nothing



How to braze the throat-plate

to beat "Boron" compo. Johnson-Matthey's supply suitable fluxes for their products; for ordinary silver-solder use borax, ground to powder and mixed with water to a creamy paste.

The last requirement is a pickle bath. I made mine from a wooden box lined with $\frac{1}{16}$-in. sheet lead, the lining having no seams in it, the ends being folded over, same as you fold a paper when wrapping up a parcel. The box has long since rotted away, leaving the lead lining, which still holds the acid pickle all right. The latter is a mixture of commercial sulphuric acid, 1 part, to water, about 16 parts; put the acid in the water, *not vice versa.* Old accumulator acid does quite well if diluted with two to three times its bulk of water. A big earthenware jar makes a good pickle bath; I know of a builder who uses a piece of drain-pipe plugged at one end; also an electrician who uses a two-gallon flint-glass accumulator jar. So much for essentials; now for the job.

A Simple and Easy Process

Stand the boiler shell on end in the pan, and lean it against the back, so that the sloping throat-plate lies approximately level. Mix up some Boron compo to a creamy paste with a little water, and smear it around the joint between barrel and throat-plate, and along each side where the throat-plate flange is riveted to the wrapper. The paste is applied with a small flat stick, or strip of metal. Pile up some coke or breeze around the wrapper, almost to the level of the throat-plate, and put some inside, to about 1 in. below the throat-plate. Get your blowlamp or blowpipe going well and strong; if the former, see it has plenty of paraffin in it, and if the latter, and you are operating from a slot meter, put another coin in. If the source of heat dies out on you whilst the job is in progress, you risk a failure! Have your small tongs handy, and the stick of easy-running strip; also some dry flux in a tin lid or small jar, and the scratch wire.

Heat up the whole issue as evenly as possible, directing the flame first one side, then the other, also blowing inside under the throat-plate. The coke will catch alight and begin to glow, thus keeping up the temperature of the copper whilst the flame is playing on another part of it. When the whole wrapper and throat-plate glows dull red, give the lamp an extra pump up, and blow the flame direct on the bottom right-hand corner of the throat-plate. This will rapidly reach bright red; when it does, hold the stick of easy-running strip (coppersmiths call it spelter; so will we, for short!) in the flame for a couple of seconds, then dip it in the dry flux, some of which will stick to it. This time apply it to the now bright-red metal; and beginners will be surprised and pleased to see that it will melt at the tip, and run into the joint just as easily as soft-solder would melt and run, if they were soldering up the domestic kettle. A long stick of spelter can be held in your hand; but when it gets short, use the small tongs for sake of safety. A burn from molten metal is nasty, it takes a long time to heal, and the spelter occasionally splutters; for that reason, don't peer closely at it and risk a speck in your eye.

Move the blowlamp flame along a little, about an inch, and bring the next bit of the joint to the melting point of the spelter, which is again dipped in the dry flux and applied as before; then ditto repeato until you reach the barrel, making certain that each fresh heat overlaps the last one, so that the spelter in the joint is continuous. When you reach the barrel, give the end of the seam an extra bit for luck; then "reverse engines" and proceed to work your way around the joint between throat-plate and barrel, this time allowing each application of spelter to melt and form a substantial fillet between the throat-plate and barrel. If the heat is sufficient, the fillet should be smooth and even all the way around; I don't mean exactly a machine-like finish (though an experienced coppersmith could turn out the job like a die-casting) but a fillet free from the half-melted lumps usually nick-named "almond rock." The metal should penetrate under the edge of the barrel, and be clearly visible all the way around on the inside. If there is any bubbling, blow on the place where it occurs, dip the scratching wire in the dry flux, and scratch in the molten spelter until the bubbling stops; otherwise you will get what is known as blisters or pinholes in the finished joint.

Different Ideas

When the semi-circular joint has been completed, you can either reverse direction one more, and go to the bottom of the side joint, or start from the bottom again and work upwards. Different coppersmiths have different ideas; some prefer to do one side first, then the other, and finally go around the semi-circular joint. It really doesn't make much difference which road you take, so long as you arrive at your destination. The only point to watch carefully, is that if breaking the continuity of the process—such as leaving off at the end of the semi-circular joint and re-starting from the bottom—when you join up again, apply the flame sufficiently long to the junction point, to enable the spelter at both sides of the joint, to melt and unite, making the joint continuous. A properly brazed joint should be actually stronger than the united pieces of metal; and any attempt to tear the joint apart, should result in the fracture of the metal either above or below it, and never in the actual joint itself. I have demonstrated this on test pieces.

Let the job cool to black; then grab it with the big tongs, hoist it clear of the coke, knocking off any cinders that may be sticking to it, and carefully lower it into the pickle bath. Tip: hold something between you and the pickle bath, to intercept any splashes. I use an old rubber bath mat, or a piece of the heavy waterproof paper used for export packing. If any splashes of acid pickle alight on your clothes, they will soon look as though the moths have been at them; a serious matter in these days of coupons! If you get any splashes on your skin, wash them off with plenty of water right away; whilst the acid pickle is too weak to cause a serious burn, it causes intense irritation, and possibly small sore places. I always rub some grease, such as vaseline or boric acid ointment,

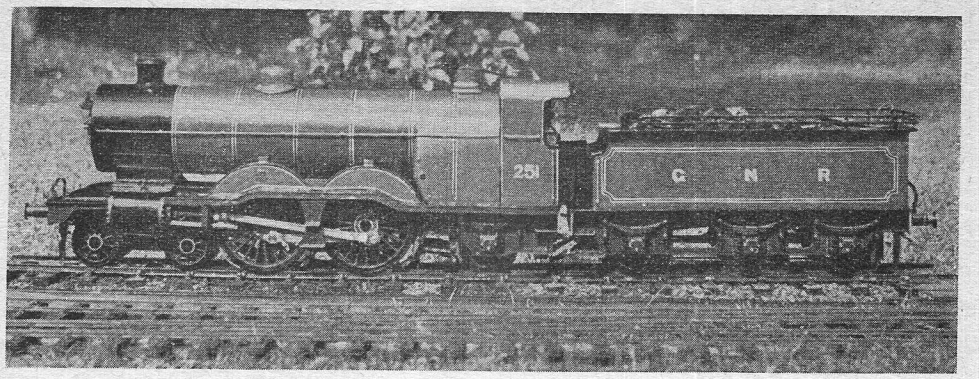


Photo by] *The original "Maisie"* ["*Bill Massive*"

over my skin before operating on boilers ; prevention is better than cure, and grease prevents acid attacking battery terminals—but you don't have to pile it on like a Channel swimmer!

Leave the boiler shell in the pickle bath for about 15 minutes, then fish it out with the big tongs, and give it a good wash in running water, to remove all traces of the acid. If there are any blobs of burnt flux still sticking around the joint, knock them off with an old file ; then give the whole doings a rub up with a handful of steel wool, or a bit of waste or coarse rag plus some domestic scouring powder. Apart from the fact that it makes the boiler much nicer to work on, dirty copper is wretched stuff to handle, and is likely to poison small cuts or scratches with which it may come in contact. Clean copper won't! If there are any rough places in the circular joint or down the side seams, trim them up with a file before you go any farther.

Further Notes on Pipe Bending

When describing how to make up the exhaust-pipe assembly, I said that if the pipes were filled with sand, and softened before bending, they would not kink. Several correspondents have commented on that, saying that whilst they fully agree, I didn't go far enough and should have elaborated the instructions a little, especially for the benefit of beginners. A professional coppersmith points out that possibly the pipe might go hard whilst actually being bent, with a risk of splitting the metal. Some say that the need for ramming the sand filling well home, should have been emphasised, whilst others say that for a small job like that, it would be better to fill the pipe with melted lead, or solder, and bend after the filling had set, melting it out again afterwards. The master plumber (Mr. D. Nicholson) who fitted up our central-heating boiler and radiators, soon after we came to live at our present hacienda, sent an interesting and instructive commentary. He says, tell the lads of the villages that the sand must be perfectly dry. Stand the pipe on end on the bench, plugged end downward, and keep tapping the plugged end to pack the sand down tightly. Bend the pipe whilst it is red-hot, thereby eliminating any chance of its hardening in the bending process, and take it a few degrees over the necessary angle ; then pull it back to where you want it. This will take out any slight flattening that may occur when making the first bend. Anyway, several heads are better than one, and I am always glad to pass on sound practical advice, *and* give credit where due.

One thing which all professional coppersmiths always take into account, and which amateurs usually neglect altogether, is the fact that when you bend a piece of tube, the metal on the outside of the bend stretches, and becomes thinner than the main part of the tube ; consequently a tube which has to carry steam or water under pressure, and has bends in it, should be made of much stouter material than a straight pipe used for the same purpose. I had an unpleasant experience of this, when the local gas company's fitters installed an automatic gas boiler in our kitchen, some years before the war. They were all right on the gas-fitting part, but not so hot as plumbers, for they connected up the boiler with compo pipes to the main water supply pipe, which was of iron barrel ; the pressure in our mains is pretty high. There were five sharp bends in these pipes. Three weeks after the installation, the sharper bend of two, in one short length of pipe, burst on the outside and flooded the kitchen. I took the pipe out and replaced it by a copper pipe in the shape of a letter S. Pipe No. 2 burst in the bend at 4.30 a.m. on a winter's morning. Luckily, I was restless that night, and heard the sudden hissing, so was able to turn the water off before too much damage was done. This also was replaced by a copper pipe, with silver-soldered unions. I was just thinking of forestalling pipe No. 3 before it went, when a tap in the house next door developed washer trouble and started hammering. My neighbour, being deaf, she didn't hear it, and away went our other pipe! That was replaced by a copper one, so all the lot are now copper ; and, needless to say, we had no further trouble. When the water company's inspector made his periodical round in search of leaky tap washers and such like, he looked at the copper pipes, grinned at me, and remarked "I can see the gas company didn't do *that* job!" Apparently we weren't the only "victims"!

Eliminating a Joint

Incidentally, several beginners have asked why I never specify bent ends for superheater elements instead of brazed spearheads or return bends, thereby eliminating a joint. The reason is as above. If you bend a piece of tube practically double, which is necessary to get it into the flue, the metal on the outside of the bend will stretch to half, or less, than its original thickness ; and what makes it worse still, the "knuckle," already thinned by the bending, is exposed to the heat of the fire, and gets the full benefit of the scouring or sand-blast action of any cinders which happened to be pulled through by an engine with a vigorous blast. Consequently, what with the heat and the scouring, such a weak place would, naturally, soon give up the ghost under pressure. True, the bent pipe could be reinforced on the outside of the bend, by having a little block of copper brazed to it ; but whilst you are doing that, you might as well braze on a proper return bend and be done with it, especially as it makes certain of unrestricted passage for the steam.

"Maisie" Still Going Strong

A letter recently arrived from my old friend "Bill Massive," enclosing the reproduced photographs of the original super-detailed "Maisie" which I built ten years or so ago, and the rebuild of the Carson "Caley." He says "Maisie" wants a new set of firebars, as the old ones are burnt out ; otherwise she is O.K. The Caley is also in excellent trim. Beginners may be interested to learn that it was on this engine that I first tried the wheeze of putting a proper locomotive-type coal-fired boiler inside the casing of the original water-tube boiler, the casing acting as a cleading, with a $\frac{1}{8}$-in. air space between it and the boiler, in place of felt or asbestos lagging. Years afterwards, the "air lagging" was adopted for the full-size "Austere Adas" ; so once more, big practice followed small.

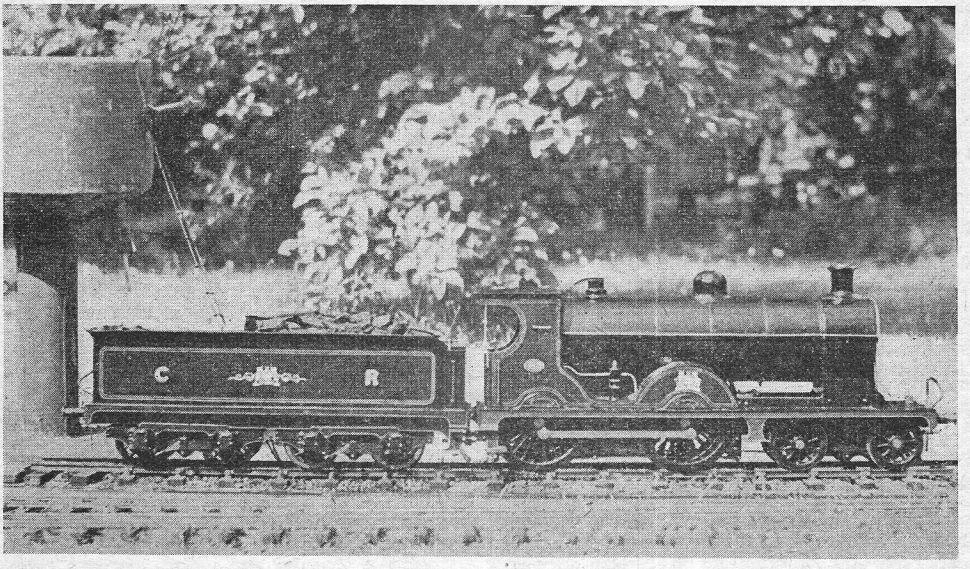


Photo by] *Built by Carson; re-built by "L.B.S.C."* ["*Bill Massive*"

A MODEL THEATRE EXHIBITION

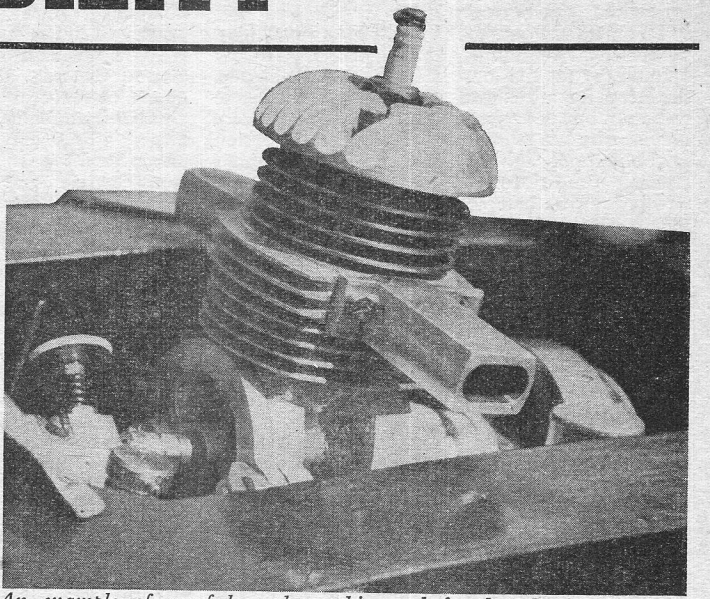
THE British Puppet and Model Theatre Guild held its first post-war exhibition at Victory House, Leicester Square, London, from September 30th to October 5th. A great variety of interest in this fascinating hobby was made up of marionettes, glove puppets, rod puppets, model theatres, backcloths and scenes.

An enjoyable excursion into the realm of fancy was provided by two scenes from "Aladdin," presented in the early Victorian manner with theatre and players cut from cardboard, and highly decorated. The accompaniment of an old-world musical box helped immensely to create the right atmosphere. The transformation scene was enlivened by the anachronism of an aircraft of improved type. The model theatres generally were very fascinating, with many original and imaginative stage settings portrayed. One model that claimed attention had a full range of effects lighting with a complicated switchboard almost worthy of its prototype. Our visit was nicely rounded off by watching the able performance of the Sherwood-Moore Marionettes.

★PETROL ENGINE TOPICS

RELIABILITY

By EDGAR T. WESTBURY



An example of careful workmanship and forethought in design: Mr. Curwen's 5-c.c. two-stroke speed-boat engine

AMONG the many other mechanical factors which have an influence on the reliability of an engine, the security of bolts and screws, not only those in the structural parts, but also those in locking devices and frictional adjustments on controls, deserve special attention. Structural fittings may be kept secure by various forms of anti-slackening measures, which are so well known in mechanical practice as to need no description here. I may mention that I have always found spring washers of the "Grover" or "Shakeproof" type very effective on small engines; the more elaborate methods, such as castellated nuts, in conjunction with split pins, are difficult to apply to very small bolts, and may complicate assembly to an undesirable extent.

The shifting of control adjustments is a prolific source of engine trouble, and there is room for considerable improvement in the arrangement of the control gear in many model boats, cars, and aircraft. Carburettor jet or air controls without some effective checking device are worse than useless; and another thing equally important is the provision of some means of verifying jet settings at a glance, without having to "search" for the correct settings. The tiny "shirt-button" control knobs fitted to some commercial engines are an abomination; large-diameter knobs with a plainly marked index, or at least a single mark to indicate the optimum setting, are much better, and will be found on most of the engines which succeed consistently in competition events.

Incidentally, an ingenious device which has been employed by some members of the Pioneer Model Racing Car Club, is the attachment of a numbered disc (obtained from a Veeder or other type of counting mechanism) to the jet adjustment screw. The large and extremely legible figures on the disc make it very easy to set the jet to a predetermined adjustment—or to any plus or minus amendment which may be indicated—especially if a fixed index pointer is also provided on the carburettor.

* *Continued from page 230, "M.E.," September 5, 1946.*

Air shutters, when fitted, should always be wide open for the attainment of full speed performance—if the engine will not take full air, it indicates some fault in the design or functioning of the carburettor, assuming that the choke tube and jet proportions are correct for the size of engine—but if running control of the air supply is regarded as necessary in any case, a control lever with a marked quadrant, or similar means of verifying the setting, also an effective frictional or other check device, must be provided.

The usual friction lock of the ignition control is fairly satisfactory, providing that it is adjusted to the correct degree of tightness, and can be relied upon not to slacken off in use. Cases have been recorded where a tight friction fit has not been sufficient to prevent movement of the control under the effect of severe vibration; a fault which should obviously be tackled at its source. The effect of such movement is usually to retard the ignition, but in a few instances, ignition timing has become advanced in some inexplicable way. There is a strong case here, also, for the fitting of a quadrant to verify exact settings, and this might be notched or serrated to check any possible risk of movement of the lever.

Delay-action Devices

These are frequently fitted to speed-boat engines, to assist in getting the boat away, and they also have possible applications in other types of models. Trouble is, however, sometimes caused through the delaying device working erratically, or failing to work at all.

Although there are many different types of delay action devices, and a full description of their working principles would be out of place here, it may be mentioned that the most popular, and certainly the simplest, type is that consisting of a dashpot with an adjustable leak, so that the time factor can be controlled.

The medium employed in the dashpot may be either air or liquid, the former being, in my opinion, by far the more reliable, as it eliminates the need for a packing gland, and is not liable to be put out of action by leakage. If oil is used, its viscosity has a pronounced effect on the action of the dashpot, and may vary considerably under climatic conditions. Should the barrel of the dashpot not be completely filled, the air cushion left in it may cause erratic motion. Fluid dashpots may, however, be made much smaller than air dashpots, and their action, when in working order, is far more powerful and positive.

Some of the commercially-made timers for model aircraft engines are capable of being adapted to work as delay-action control devices, with very little alteration.

Ignition

If there is one form of engine trouble which is excusable at the present time, it is that in connection with ignition. The average constructor, being dependent on bought components to provide the ignition spark, may reasonably plead that he cannot be held responsible for deficiencies in coils, batteries and sparking plugs. But if the available ignition accessories are, in fact, unreliable—and it must be admitted that one often encounters grounds for complaint in this respect—it is not beyond the ability of the model engineer to design and construct any or all of them for himself, to a standard of reliability and efficiency far above that of the usual commercial article. The fact is that most constructors fight shy of electrical equipment, regarding it as outside their legitimate scope; an attitude of mind which is not truly consistent with model engineering principles.

One point which should be remembered about the ignition equipment of racing engines is that it calls for a higher standard of electrical efficiency than that used on engines of more modest performance. The latter are usually of lower compression ratio, run cooler, and can tolerate an occasional misfire better than the racing engine. A racing two-stroke, for instance, imposes a particularly exacting duty on the ignition equipment, for it not only requires twice as many sparks as a four-stroke for a given r.p.m., but the sparking plug is subjected to extreme conditions of oiling-up and high temperature. Many two-strokes fail to produce the results of which they should properly be capable, purely because of the limitations imposed by the ignition equipment.

Batteries are a particularly difficult problem at the present time, because there are so few batteries available of a really suitable type for ignition duty. Most dry batteries give up the ghost very quickly when applied to this job, for reasons which have already been dealt with in my articles on Ignition Equipment. Some form of accumulator, with an adequate reserve of current capacity, seems to be almost a necessity for efficient ignition. But whatever form of battery is used, it is undoubtedly important that the ignition coil used with it should be designed to suit its current output characteristics; it is not sufficient to obtain a "good" coil, and expect that any "good" battery ought to be able to supply it with current.

With regard to the magneto, which is, without doubt, the final answer to all battery troubles, many constructors are scared off by the real or imagined difficulty of constructing it; but a good many others are concerned about the power taken to drive it. I have dealt with this in the above articles, and would only add that, from the point of view of reliability alone, the magneto is worth while, even though it may *possibly* reduce the speed of a boat or car by a fraction of a mile per hour. There are few of those who have tried magneto ignition on a model racing engine who would willingly change back to a battery and coil system.

Contact-Breakers

In my experience, an unnecessarily large proportion of ignition troubles are traceable to the contact-breaker, which is often of inefficient design or incorrectly adjusted. Basically, it is the simplest thing on earth to design a device which will open and close an electric circuit, but in practice, there are few components in the engine which require more forethought in design, or care in construction and adjustment. Even though the contact-breaker may appear to operate perfectly when the engine is turned by hand, its behaviour at high speed may be very different; and mere opening and closing of the contacts, at any speed, does not necessarily constitute efficient operation. Model engine contact-breakers work under very adverse conditions, especially in respect of oiling-up of the contact points, and as it is very difficult or practically impossible to keep them entirely free of oil, it is necessary to ensure that sufficient pressure is applied to the points, when closed, to ensure true metallic contact between them. A comparatively small clearance gap between the contacts, when open, is desirable to allow them to work at the maximum speed without undue mechanical load, as the power absorbed by a contact-breaker, neglecting that expended in friction between the cam and follower, must necessarily depend on the distance the latter moves against the pressure of the spring. But small contact clearance is only practicable if the design and construction of the breaker is such as to ensure smooth and positive action, without spring ripple or bounce.

The design of contact-breakers for model petrol engines has been discussed many times in my past articles, and several designs for throughly efficient and reliable breakers have been published. Some of these have been criticised on the grounds that they are not as neat as they might be in appearance, and considerably out of true scale proportion to the size of the engine.

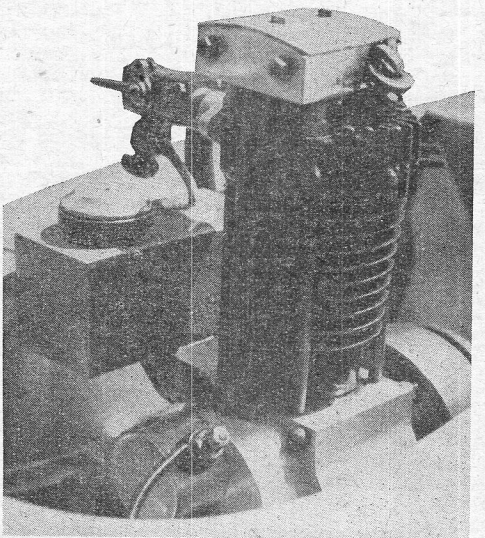
I am all for encouraging neatness in design in any components of model engines, but there are practical difficulties in producing really neat

and compact contact-breakers, which are at the same time sufficiently robust and accessible to ensure their reliable operation. "Scale model" contact-breakers may give trouble, not necessarily through any fault in their design, but because they are delicate, inaccessible, and finicky in adjustment. Enclosed contact-breakers are good in principle, but only too often become undesirably efficient oil-collectors; and most users prefer the open type of breaker, if only because they can see it working.

Bad connections account for a good deal of ignition trouble, and I find that many users of engines, in hurriedly installing an engine, carry out the wiring in a very slip-shod manner. In my own engines, I have often been led up the garden by such troubles as loosened terminals, chafed insulation, and broken wires; I have found it desirable to carry out routine tests of the wiring system at frequent intervals.

Carburation

The majority of carburation troubles are due either to incorrect adjustment or shifting of controls, as previously mentioned. It has been proved that even the crudest designs of carburettors are capable of giving good results if correctly adjusted; but the trouble involved in adjusting a crazy carburettor is often out of proportion to that which would be entailed by scrapping it and making one which works on sound principles.



Another outstanding miniature engine: Mr. Weaver's 10-*c.c. o.h.v. four-stroke*

Carburettor adjustment can be very much simplified if one takes the trouble to study the principles on which carburettors work, and apply this knowledge both to design and adjustment. So many users still cling tenaciously to old and fallacious notions; one of the most prevalent errors is still, as ever, the idea that carburettor adjustment consists of screwing the jet needle down until the engine races its head off on no load. All that one really does in such cases is to weaken the mixture practically to the stalling point, so that it is just capable of keeping the engine running until it has some work to do—when it promptly peters out.

Many small details may have far-reaching effects on the carburettor, in view of the very small quantities of fuel which must be accurately metered. Very minute leakages of either fuel or air around the jet will upset all attempts at adjustment; and a loose jet screw, which allows the control needle to wobble around in the jet orifice, or a worn, bent, or ridged needle, is equally fatal to consistent results.

Many engines are prone to mysterious stoppages, the causes of which are very difficult to trace. Most of these are due to some temporary interruption of the fuel feed, and the most careful subsequent examination of the carburettor and fuel system may fail to reveal any clue to the source of the trouble. Sometimes vibration will cause the formation of air bubbles, which air-lock the feed pipe and prevent fuel reaching the jet. In boats and cars which run on a circular course, centrifugal force may cause the fuel to pile up at one side of the tank and leave the fuel pipe high and dry.

Pipes and connections in the fuel system may give trouble, either by restricting the free flow of the fuel, or by setting up conditions conducive to the formation of an air lock. Unions, stop valves, and fuel filters should always be carefully investigated in the search for potential focal points of trouble. As a result of experience, I am against the use of rubber in any shape or form in fuel or oil pipe lines, unless it can be definitely *proved* capable of resisting petrol. I have found that even with rubber pipes claimed to be petrol - resisting, minute flakes of the material may be scoured away and carried in the fuel, to deposit eventually in the jet.

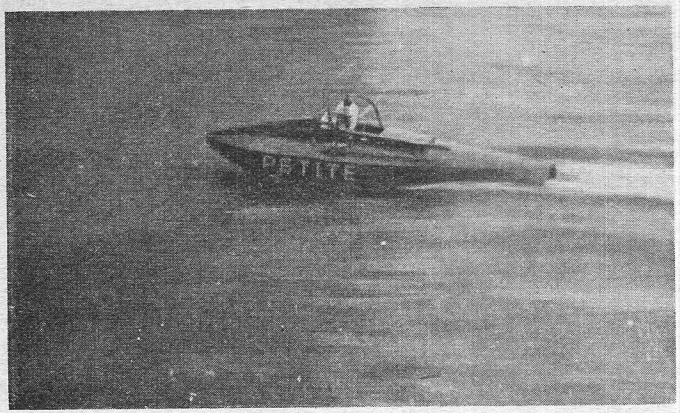
Filtering of the fuel, or fuel-oil mixture, should never be neglected, and even when this has been done, it is remarkable what a proclivity it has for picking up new impurities; the cleanness of any sample should never be taken for granted. A fine filter screen in the funnel, and another inside the tank, are by no means idle or superfluous precautions. Decomposition or chemical action in fuels may often cause precipitation of foreign matter, and I have occasionally found a deposit of a substance like resin or varnish inside fuel passages when an engine has not been run for some time. In two-stroke engines running on petroil mixture, one may find, after the engine has been laid up for some time with fuel in the tank, that the petrol has evaporated, and left a sticky mess of oil in the pipes and passages, which may be extremely troublesome to clear out. The obvious remedy is, of course, to drain all fuel and oil meticulously when the engine has finished its running for the day.

Other functions of the engine, such as cooling, and lubrication, are all capable of adding their quota to "the things that can happen," and it is only by the most painstaking attention to every little detail that one can hope to achieve complete reliability.

MODEL POWER BOATING IN WARTIME AND AFTER

by

E. A. WALKER

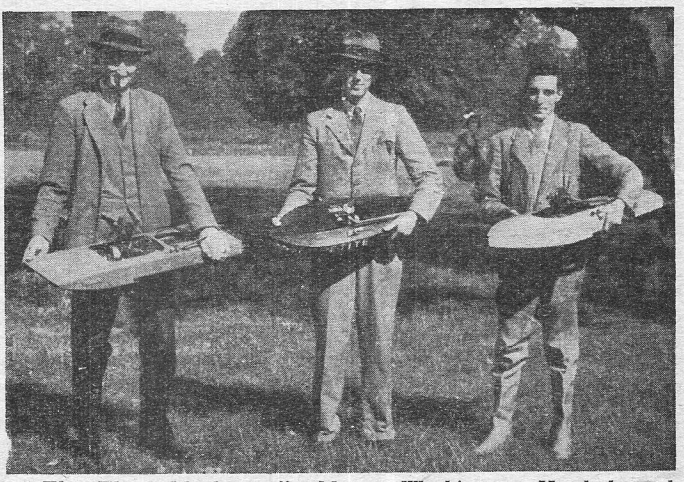


Mr. Walker's "Petite" at full speed on the pond at Beddington Park

NOW that the war is but a memory, and interest in the running of model speed boats is slowly but surely reviving, it may be of interest to recall the struggles of a small band of enthusiasts to carry on running boats during the "Doddle-bug" era. In the search for a pond which was not either closed to the public or commandeered by the N.F.S. for static water or fire-engine drill, or by the Army for bridge-building manoeuvres, the small pond at Beddington Park, Wallington, Surrey, was discovered, and many hours of running round an improvised pole were enjoyed in the intervals between running for shelter as the unwelcome visitors from the Continent made themselves heard, seen, and occasionally felt. The sound of our boats' engines bore a sufficiently close resemblance to that of the buzz-bombs to call for some investigation by a local A.R.P. official, but no disturbance was caused to residents in the vicinity—at least not by the boats—as the nearest house was quite a good distance away.

In the somewhat less hectic days of peace we are still endeavouring to carry on the good work, and should be glad to hear from other enthusiasts in the neighbourhood with a view to the possible formation of a local model power boat club. The pond, being on the small side, does not allow of running a full 100-yard lap, but a course of 66 yards circumference is practicable. There are no silencing regulations in force *at present*. I should be pleased to hear from anyone who would like to join us at any of our informal gatherings at the pondside.

The boat shown running in the photograph has a hull built to the "Little Star" design by "Spectator," published some years ago in THE MODEL ENGINEER. It is a two-step hydroplane, 2 ft. 9 in. in length. The engine is a modified "Gray-spec" two-stroke of 15 c.c., which has been much improved by the fitting of a rotary inlet valve. At present I am diligently searching for a few bits of three-ply to make a new hull, in which to try out the engine and compare results with those of the existing hull. In the photograph, the boat is travelling at about 25 miles per hour, but on the short course gives the impression of greater speed. It may be mentioned that the lighter boats with small capacity engines generally behave better on a short line, and Mr. Headech's 5-c.c. Comet, which was awarded a silver medal at the recent MODEL ENGINEER Exhibition, has produced some good results in early trials on this pond. Other boats which have made test runs include Mr. B. C. Miles's 30-c.c. boat with its twin super-charged engine and Mr. Westbury's trusty (and now somewhat rusty) veteran "Golly."



"The Three Musketeers"—Messrs. Washington, Headech and Walker at the pond side

A SMALL PELTON WHEEL

J. W. H.

SOME years ago the writer was presented with a small cast-iron casing, half coated with grease and soil, which had been discovered amongst the debris of a large scrap heap.

On examination this turned out to be the casing of a very nicely constructed small Pelton wheel of 4⅜ in. "effective" diameter, with sixteen well finished and polished gunmetal buckets—as indicated by the detail drawing herewith.

The origin of the wheel has remained a mystery, but, needless to say, it was promptly cleaned and provided with a supply of its normal beverage—and a pleasing "drone" was heard.

Since its recovery from a most unworthy fate, the wheel has spent a long and useful life driving a small direct coupled dynamo, through a leather disc coupling, and charging an endless succession of wireless and other accumulators; the wheel developing about one-tenth actual horse power, as supplied, and with the controlling stop cock partly closed in order to give a suitable dynamo speed. (The dynamo was acquired from a scrapped motor vehicle.)

For this purpose the writer was fortunate in being able to feed the wheel through a short service pipe coupled to an 8 in. high pressure water main, the available head being fairly constantly about 200 ft.

However, the wheel has a remarkably good performance when supplied from an ordinary ½ in. domestic tap affording a pressure of about 40 lb. or less. (In the event of such a wheel being coupled to a town supply, it is, of course, desirable to consider the By-laws and Water Regulations.)

The buckets, which fit together around the wheel, are bolted by single ¼-in. steel bolts to two steel discs, each ⅛ in. in thickness and 3½ in. diameter. Under each bolt head is a steel washer and under each nut a spring washer.

The two discs are a close fit on the central ½ in. plain portion of the shaft. This central ½ in. portion of the shaft is threaded (apparently with a gas thread) for ¾ in. at either side of the wheel, so that the discs can be tightened up against a gunmetal collar which also is a close fit on the plain ½ in. shaft.

The tightening is effected by two large hexagon nuts and two copper washers.

There is no key or locking device for the discs, but no sign of slipping has been noted, despite the extremely high speeds at which the wheel has been run.

The ½-in. shaft is reduced to ⅜ in. when it runs in the bearings, which are flanged gunmetal bushes fitted in the split cast-iron casing. The bearings are each ⅝ in. in length.

The casing allows ample clearance around the wheel and is entirely open at the bottom to allow the water to fall freely away from the buckets.

The tapered gunmetal nozzle is 2 in. long with an internal diameter of ⅜ in. at the inlet end and a nozzle diameter of 3/16 in., slightly opened out at the extreme end. No needle valve is fitted and control has been by means of an ordinary stop cock or domestic tap situated about four feet back along the supply pipe, which is of ½-in. bore.

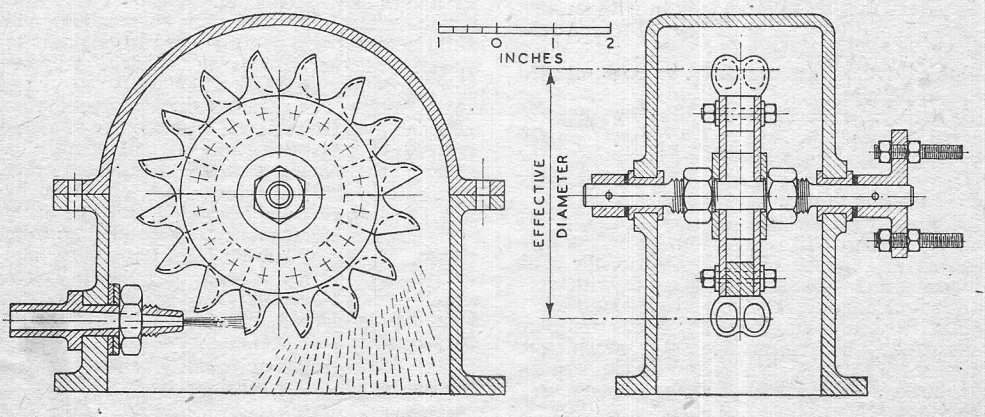
As may be seen from the drawing, the buckets are of correct pattern, each having two spoon shaped "vanes" divided by a sharp central ridge which splits the jet, as in a full size "Victoria" impulse wheel.

The outer edge of each bucket has a small central notch which permits the jet to exert its full effect for a little longer period on each bucket as it approaches its lowest and most effective position. (In a full-size wheel a portion of the bucket is often cut away for this purpose.)

The tapered shanks of the buckets fit accurately together and between the steel discs, and the bucket vanes have been scraped and polished.

A coat of green paint on iron and steel portions of the wheel and casing is still in a fair condition. Grease cups are fitted to the bearings, but thick motor oil has been used for lubrication.

It is hoped that the details given may be of assistance to any MODEL ENGINEER readers who may decide to construct a well proportioned Pelton wheel.



The following notes are added as a guide to any who propose to do so :—

With a water motor of this type the maximum torque is available with the wheel at rest, which is a great advantage when starting up or running at low speeds.

However, the maximum power is derived from the jet when the water leaving the buckets falls freely and generally vertically away from the wheel—with all its energy expended.

This will be found to occur when the buckets are travelling at about half the speed of the jet.

The wheel described drove a direct-coupled dynamo when coupled to a high-pressure supply, but on an average domestic supply its speed for maximum power output is about 500 r.p.m.

Probably most model makers would wish to construct a wheel which would give maximum power output when coupled to an average domestic supply and when running at a suitable speed for driving a direct-coupled small dynamo. For this purpose, a working speed of around 2,000 r.p.m. will be desirable, and the following considerations will determine the best size of wheel for this purpose.

A 5/32-in. nozzle, coupled to an ordinary average domestic tap supply, will pass something like 700 cu. in. of water per min., and since the jet in this case has a cross sectional area of about 1/50 sq. in., its speed is, therefore, about 35,000 in. per min. (or 33 miles per hour).

The best working speed for the buckets of a wheel supplied by such a jet will be about half of 35,000, say 17,500 in. per min.

In order to achieve a good working speed of 2,000 r.p.m., or thereabouts, a 3-in. "effective" diameter wheel, with a circumference of about $9\frac{1}{2}$ in., will thus be suitable.

The writer would recommend this size of wheel for this purpose and also because it is a convenient size for the average model maker's resources to cope with. It is further suggested that a satisfactory wheel of approximately 3 in. effective diameter could be constructed to the dimensions of the wheel described above—reduced to three-quarter size, but the half-inch clearance between the wheel rim and the casing should be preserved, to avoid spray and air "drag."

The tapered portion of the 5/32-in. nozzle might very well be $1\frac{1}{2}$ in. in length, with an inlet diameter of $\frac{5}{16}$ in. The inside of the nozzle should, of course, be quite smooth.

Alternative nozzles can easily be experimented with, if desired.

It will be seen from the drawing that the bucket faces are inclined or "set back" on the wheel, and this is considered to contribute to the efficiency, partly by facilitating the free discharge of the buckets as they leave the jet.

A little patience and care in finishing the bucket castings will be well repaid by the production of a power unit of exceptionally high efficiency and capable of a long life with very little to replace to restore it to a new condition.

The writer has sometimes found red-fibre block to be a convenient material from which to make small patterns such as the one required for the buckets, and some of the "implements" included in manicure sets are not to be despised for shaping.

It would be advisable to have twenty buckets cast, in case any should be spoilt during finishing. The finished buckets should be as closely identical in weight and shape as possible, and after assembly, the wheel should be balanced by a little judicious filing, if necessary.

The central portion of the spindle might be threaded throughout (with a moderately fine thread) for the 3-in. wheel, and the plates, nuts and washers, should all be close fitting.

Continuous lubrication should be provided for the bearings, a wick feed being suitable. The casing for a 3-in. wheel could be cast in gunmetal, and the outside polished, at little extra cost.

Those who prefer not to use castings for the casing would find little difficulty in devising a casing built up from stout steel or brass plate, with plain bearings bolted to the sides.

If stainless steel is obtainable, its merits for various parts of such a model should not be overlooked.

A satisfactory method of disposing of the discharge of the wheel would be to mount the wheel, and any coupled unit, on a well painted hardwood board, with a slot cut out of the board to match the inside of the casing, and to fit the board over a metal tank (say 12 × 8 × 4 in. deep), the tank having an outlet pipe of 1 in. internal diameter at one end—leading to a sink waste or drain.

Coupled to a fairly good domestic supply, a 3-in. wheel of this type will develop about 1/80 to 1/100 horse power, and any small dynamo, direct coupled, should be such as will require this power for its rated output.

In conclusion, it may be pointed out that a 3-in. Pelton wheel, running on a domestic service pipe, may well consume 150 gallons per hour. (This quantity may be conveniently visualised as the capacity of 75, 2-gallon petrol tins, and would be a liberal supply for a household of five persons for all purposes, including incidental waste, for twenty-four hours.)

It is, therefore, natural for water authorities to regard the regular use of small water motors as falling within the category of "industrial purposes."

Although water charges of different authorities are notoriously variable, an eight-hour run with a 3-in. wheel may cost somewhere about one shilling, and it will be for the model engineer to consider whether this is a "financial proposition" or otherwise worth while.

A more sinister calculation may suggest that a £2 fine would correspond with the cost of about 320 hours' legitimate running, and it may be relevant to remember that up-to-date water authorities equip their inspectors, especially by night, with testing devices which are quite likely to detect the pleasant drone of a small Pelton from a distance, and to trace it relentlessly to its lair!

The sides of the casings of full-size Pelton wheels are occasionally fitted with rectangular framed glass panels, so that the action of the jet can be observed.

Such panels might quite easily be incorporated in a model, with attractive results.

*COUPLINGS

By

Old Gaumless

IN this second section of my article dealing with couplings, we now come to consider the variety commonly called "flexible." This term is apt to be rather confusing to the untrained mind, for the word itself tends to convey the impression that the coupling resembles something in the form of a jelly which will wobble in any direction. In fact, some of the latest flexible couplings actually do try to perform in such a manner, but there are also others with only a fixed amount of movement and which are very little better than ordinary rigid couplings. It all depends upon what duties the couplings are called upon to fulfil.

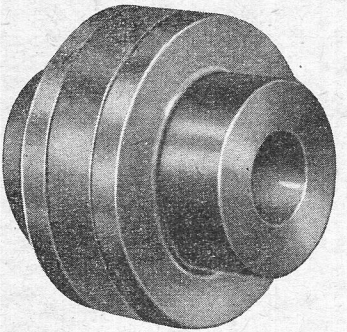


Fig. 2. *"Perfect" coupling with centre disc of rubber*

At some time in his career nearly every engineer has been seized with an idea for, or has actually produced, a flexible coupling. Literally thousands have been made and one has only to watch the patents as they are published in the trade journals

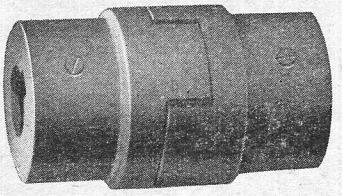


Fig. 3. *"Light" type, note claws*

to realise that there is no apparent cure for the disease. Model engineers are no more immune from attack than their "professional" brothers, and for years the columns of THE MODEL ENGINEER have regularly described some one or other's idea for one of these couplings.

*Continued from page 636, "M.E.," Vol. 94, June 27, 1946.

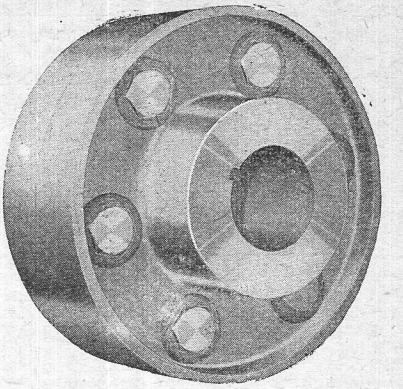


Fig. 1. *Pin and buffer coupling. Pins in one half only, not alternate*

It is my purpose, therefore, to make an attempt to describe and illustrate a truly representative cross-section of the very many types in common usage today. It would be impossible, of course, to even try to include all and every type of coupling, and I have been very careful to pick out illustrations which embody the main principles of definite types. For instance, if you will consider the pin-type coupling as illustration Fig. 1, you will readily see that by cutting slots instead of the holes, we get the pin and slot type of coupling so commonly used on propeller-shaft drives in our model ships.

Whenever we have to couple together two shafts which perform a varied assortment of movements we invariably turn to the "flexible." This is not quite fair to our hero (a hero it is !), for there are other types of couplings which have been developed to handle such things as angularity, contiguity, expansion, etc.

Forty or fifty years ago, a flexible coupling was a very simple affair when compared with the latest developments and if it would damp out small amounts of shock and allow for very slight end-float, expansion and misalignment, it complied with average requirements. The latest flexibles are a combination of nearly every type of coupling and can cope with conditions unheard of

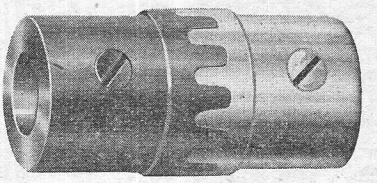


Fig. 4. *Note form of teeth*

only a few years ago. Even so, it must be borne in mind that a flexible coupling is *not* something we introduce into our transmission systems to correct *existing* faults such as axial or angular misalignment, shaft contiguity, or anything else that is seriously wrong. But it *is*, or *should* be, something that will make an attempt to handle these irregularities should they develop *after* the

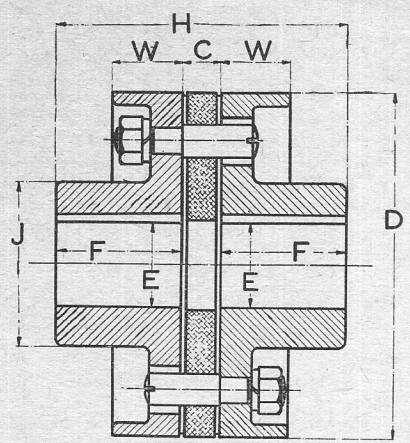


Fig. 5. With central "flexible" disc

power transmission, their primary object is to protect driving and driven machinery from any detrimental effects *which may arise* due to misalignment of shafts, vibrations, sudden shock loads, end-float or movement, shaft expansion, etc. It will be appreciated therefore that the selection of the correct type and size of coupling is as important as that of the driving and driven mechanisms in order that full protection coupled with highest possible efficiency will be obtained."

The italics are mine. Quoting again, "Correct alignment of couplings is essential to ensure satisfactory driving; it is important therefore to take every care that couplings are fitted correctly and that the shafts are perfectly aligned before starting up. It is advisable also to check alignment at regular intervals and to correct misalignment due to settlement of foundations, wear in bearings, or any other cause."

And here again, "Flexible couplings are *not* intended to overcome serious or permanent misalignment of shafts which must be rectified at the earliest moment." Again the italics are mine. I may appear to have harped upon this matter, but I make no apology. It is vital!

installation has been put to work. Even then, the faults should be rectified at the earliest possible opportunity. Why? Because any of these troubles can cause unnecessary wear of parts, increased friction with allied efficiency losses, and impose all sorts of stresses and strains upon the mechanisms, with resultant failure.

What Are They For?

Let me quote from a catalogue published by one of the largest makers: "Flexible couplings are an indispensable feature of modern

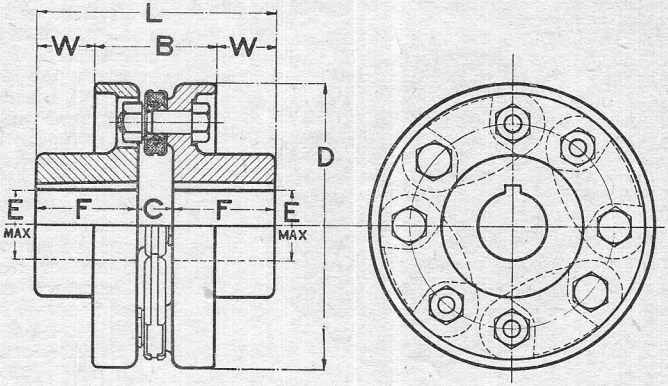


Fig. 6. With flexible links

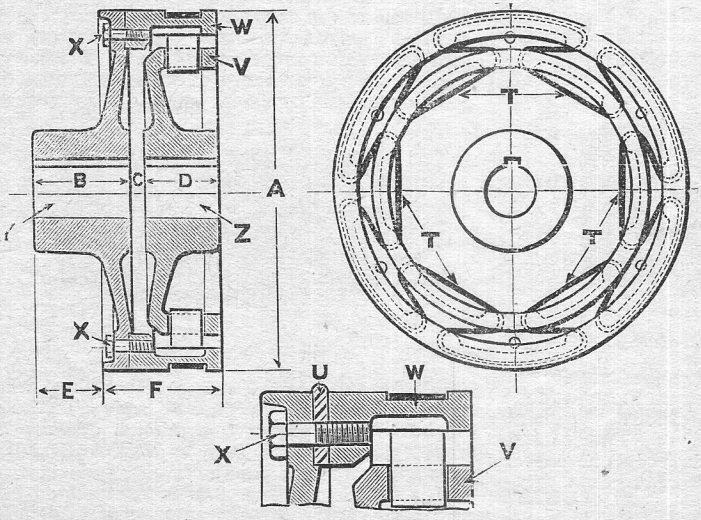


Fig. 7. Note how belt is "laced"

Variety of Types

Having cleared the way, therefore, let us now proceed to examine a number of couplings which have been successfully applied. As I have said, the illustrations have been chosen with a view to rendering their construction quite clear without need for a great deal of written matter.

Fig. 1. "Pin" Type

For all powers. One of the most popular. Cast-iron or cast-steel halves,

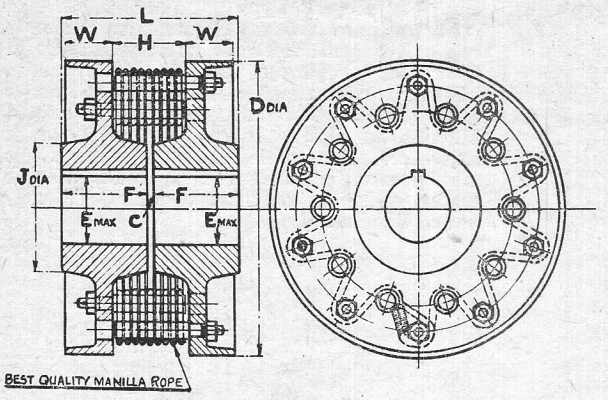


Fig. 8. Rope is simple, cheap and effective

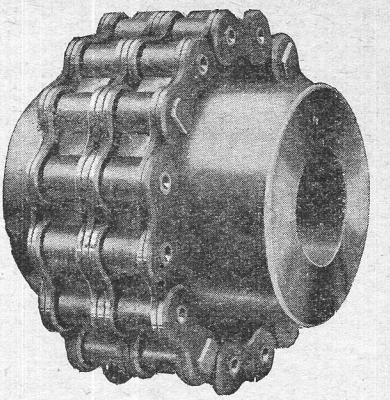


Fig. 9. The "chain" coupling

with steel pins and non-conducting buffers in leather, rubber, fabric-rubber, etc. Reversible, insulating, allows for slight shaft misalignment, expansion and end-float, absorbs impulses and vibrations. Patented in various forms.

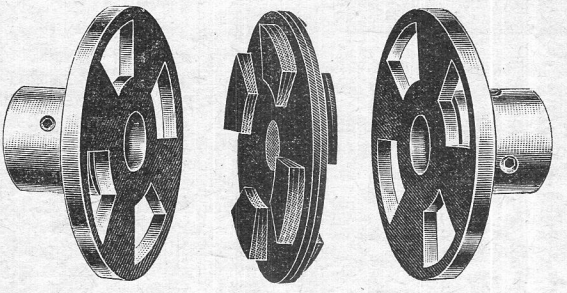


Fig. 10. Grundy's patent

Fig. 2. "Perfect" Type

For small powers. Two die-cast or cast-iron flanges with projecting lugs which engage in slots provided in a centre disc of vulcanised rubber or chrome leather. Reversible, insulating, absorbs impulses and vibrations. Will also accommodate slight end movement, shaft misalignment, and angularity. This coupling is really a development of the concentric coupling with which I dealt in the last section.

Fig. 3. "Light" Type

For small powers. Machined all over from solid steel, with three jaws, each fitted with a non-metallic facing, which cushions and absorbs shock. Reversible, insulating, allows for only

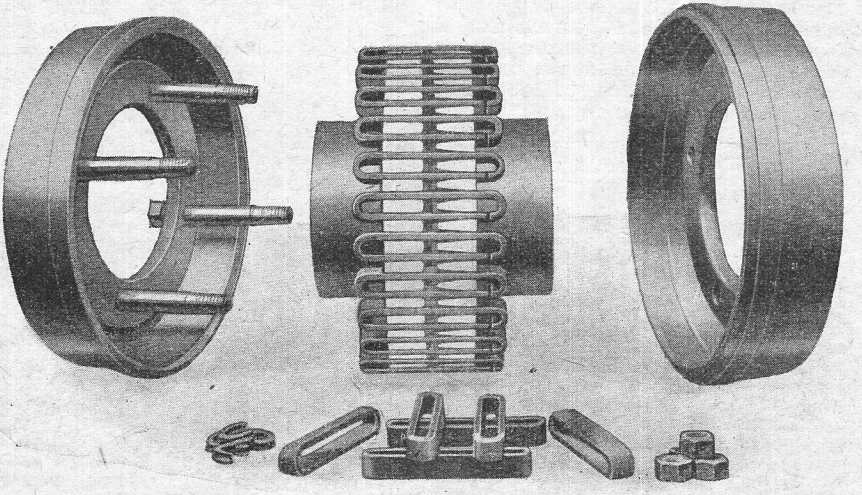


Fig. 11. Note "spring" driving elements

slight expansion and end-float. Note similarity to the " claw " clutch.

Fig. 4. " Semi-flexible " Type
For small powers. Solid steel, machined all over, having machine-cut teeth eliminating free

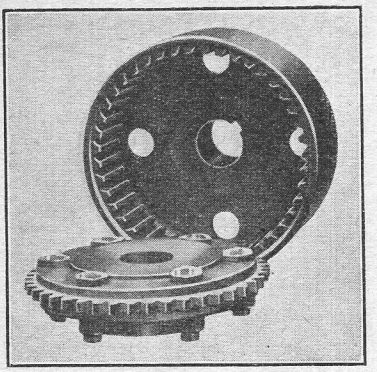


Fig. 12. The " superflex "

play and backlash. Reversible, non-insulating, will accommodate slight shaft misalignment and angularity up to 10 deg.

Fig. 5. " Disc " Type
For medium powers. A development of the motor-car type. Cast-iron flanges with centre disc of rubber-fabric or leather. Reversible, insulating, permits of a greater degree of misalignment than is possible with most other designs. Also (in more limited degree) provides for shock loads, impulses, vibration and slight end-float. I shall refer to this again under universal joints.

Fig. 6. " Link " Type
For medium powers. Cast-iron flanges with patent flexible links, with steel pins alternate in each half of flange. Reversible, insulating, allows for misalignment, end-float and expansion, damps out vibrations, is exceptionally flexible and provides for large torque elasticity.

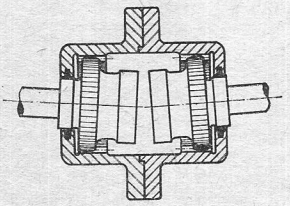


Fig. 14. Angular misalignment

Fig. 7. " Empire " Type
Powers up to 1,000 h.p. at 100 r.p.m. Cast-iron inner and outer halves connected by textile belt. Non-reversible, insulating, will absorb shock, take up slight shaft misalignment, angularity and end movement.

Fig. 8. " Rope " Type
For medium powers. Construction is simply two cast-iron flanged discs fitted with studs in each half at different radii from the centre. Manilla or cotton rope is wound over and under alternate studs. Particularly suitable for isolated districts, as rope is usually obtainable almost anywhere. Reversible, insulating, allows for misalignment, end-float and expansion, absorbs shocks and vibrations, can be quickly disconnected by removal of rope.

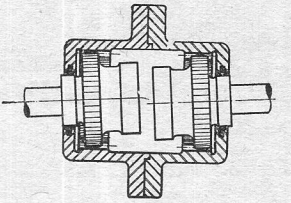


Fig. 15. Parallel misalignment or contiguity

Fig. 9. " Chain " Type
For medium powers. Consists of two chain-sprockets coupled together by duplex roller chain, which permits slight irregularities in shaft alignment, absorbs starting-up shock, etc. Non-insulating, reversible.

Fig. 10. " Grundy " Type
For medium powers. Three pieces only, i.e. two cast-iron flanges with leather centre-piece. Reversible, insulating, allows for shaft misalignment both axial and angular, provides for shock loads, impulses and vibrations, end-float and expansion. Patented.

Fig. 11. " Multiflex " Coupling
This little chap will handle anything between 1½ h.p. to 5,000 h.p. and more, at 100 r.p.m. All metal, the illustration quite well explains its construction. Reversible, non-insulating. Flexibility can be increased by removal of opposite

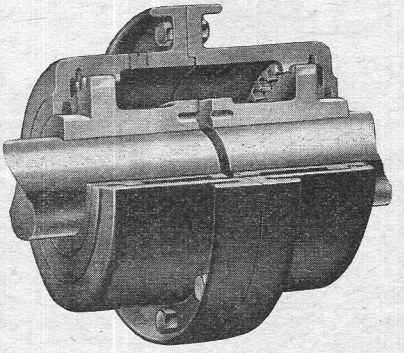


Fig. 13. Cut-away view of internal gear type

springs. Used for all the heaviest drives, it is totally-enclosed, self-lubricating, and will deal with misalignment of shafts, strains due to yielding of supports, uneven wear in bearing,

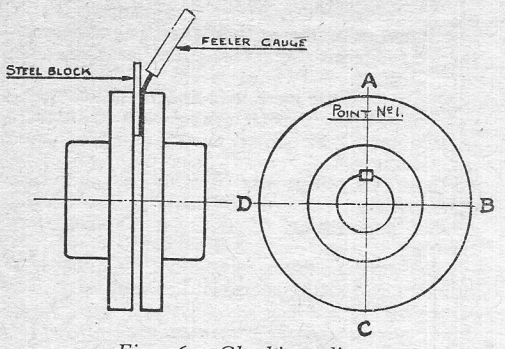


Fig. 16. Checking alignment

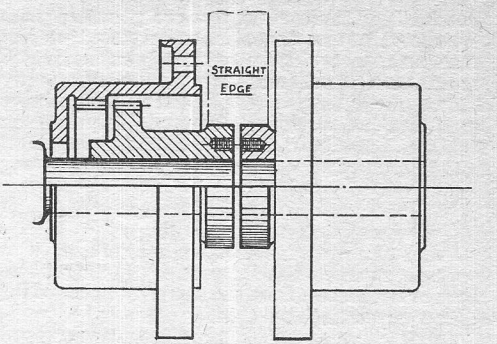


Fig. 18. Checking level

vibrations, shock loads, and slight end-float. Will also reduce harmonic vibrations and compensate critical revolutions. Patented in various forms.

The Latest Developments

You will remember that I referred to the latest developments in flexible coupling design which had gone a long way towards dealing with extremely bad conditions and had made some

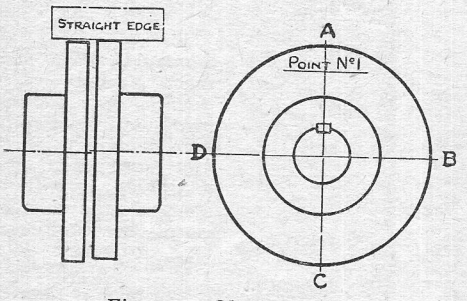


Fig. 17. Checking level

attempt to combine duties usually delegated to other types of couplings. The following then, should prove interesting.

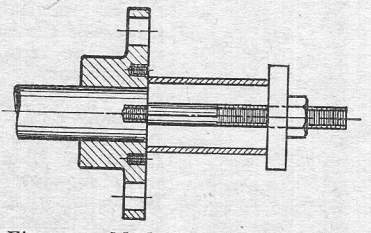


Fig. 19. Method of forcing "on"

Fig. 12. "Superflex" Type

Powers up to 330 h.p. at 100 r.p.m. Cast-iron or cast-steel shell with accurately cut internal teeth. Centre-disc is non-metallic material with cut teeth to engage in shell. Reversible, insulating, absorbs and damps out shocks, vibrations, allows for a large amount of end-float or movement, and will handle shaft angularity and misalignment.

Fig. 13. "Internal Gear" Type

Powers up to 30,000 h.p. at 100 r.p.m., a bit beyond the toy stage now! All-metal construction and again with internally-cut teeth, or gears. Note that the teeth on the inner half have spherical tops to allow for shaft angularities. Self-lubricating, will handle free end movement of shafts, continuous shaft oscillations, angular and axial misalignment, whilst possessing sufficient flexibility for all normal drives. Just *look* at the shaft position in Figs. 14 and 15.

Fitting

To conclude this section, a few words upon the subject of fitting and setting up should not come amiss, as the efficient performance of the couplings depends entirely upon how well this is done. Prepare the bores and shaft ends for a press-fit, and, following the instructions given in the previous article on "rigid" couplings, securely key each half to its respective shaft, using parallel or taper keys with sunk keyways in the shafts. Flats on shafts are not permissible. The arrangement shown in Fig. 19 can be used for forcing couplings on to shaft ends, using a tube with a larger inside diameter than the shaft end. Alignment can be checked by allowing each half to rotate independently and inserting a feeler or suitable thickness gauge at points shown on

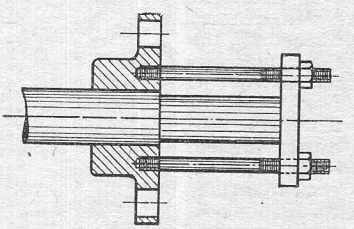


Fig. 20. Drawing coupling "off"

diagram (Fig. 16), at *A*, *B*, *C*, *D*. Rotate one half coupling from the position *A* to *B*, *B* to *C*, and *C* to *D*, testing in each position. By this method, alignment of both shafts can be checked for accuracy. To check level of shafts, rotate each half independently, using a straight-edge as illustrated in Figs. 17 and 18, at each position, *A*, *B*, *C*, *D*. This will ensure correct level being

obtained. Where couplings are provided with loose covers, the covers must be placed on the shaft prior to keying on the hub portions, which must be aligned and levelled independently before finally bolting up or inserting connecting mediums, i.e. springs, bolts, etc. When bolting up, care must be taken to see that correct level and alignment of shafts is not disturbed in any way.

Withdrawal and/or Removal

After removal of connecting mediums such as springs, bolts, etc., the respective coupling halves may be withdrawn from the shafts by either of the following methods :—

(*a*) If coupling half is provided with tapped holes on face, insert a distance-piece of smaller diameter than the shaft and screw up against the cross-plate, as shown in Fig. 20.

(*b*) An alternate method is driving the coupling off from the rear, taking care to insert a wood block behind the coupling to avoid damage.

Where couplings are rusted on, they can generally be removed by soaking in vinegar, paraffin, penetrating oil, methylated spirit, or by warming the boss with a blowlamp.

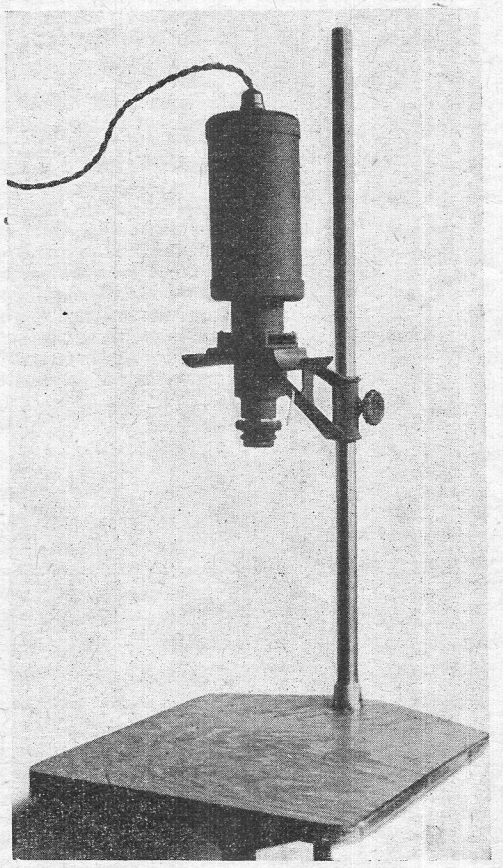
The illustrations are reproduced by courtesy of Messrs. Crofts (Engineers) Ltd., Bradford.

(*To be continued*)

CASTINGS FOR THE "MODEL ENGINEER" VERTICAL ENLARGER

THE miniature vertical enlarger designed by our contributor "Kinemette," and described in THE MODEL ENGINEER during the early part of 1940, has had a wide appeal among our photographically-minded readers, particularly in view of the difficulty in obtaining ready-made enlargers, and their consequent high price at the present time. These readers will be interested to learn that castings for constructing the enlarger are now obtainable from Mr. J. Pell, of 40, Longton Road, Blackpool, who is also issuing complete detailed drawings of the instrument, including certain minor modifications and improvements which have been approved by the original designer.

A set of castings of the enlarger have been submitted for our examination, and we find them good in every essential respect, being made in free-machining aluminium alloy, and very clean and accurate. It will be seen that the enlarger is of the cantilever type, to mount on a 1-in. vertical pillar, and it will take 35 mm. or "16 on V.P." size negatives. The optical system incorporates a condenser, and is adaptable to objectives of various focal lengths so that practically any miniature camera lens could be employed. An ordinary "pearl" electric lamp bulb is normally used for illumination, but other forms of illuminant, including low-voltage lamps, may also be used. A unique feature of design is the internal shutter, which eliminates the need for the usual detachable or swinging amber filter cap.



An enlarger constructed from the castings supplied by Mr. J. Pell

Letters

Lathe Improvements

DEAR SIR,—Mr. Niall MacNeill's interesting series of articles on Lathe Improvements did not mention what I consider to be one of the most important jobs that should be undertaken when improving any small lathe for model work, namely, the balancing of the mandrel cone pulley.

Owing to the as-cast condition of the interior, the balance is usually far from perfect and results in considerable vibration at speeds above 500 r.p.m.

I am a strong believer in having a top speed of about 800-1,000 r.p.m. available on any small power-driven lathe, as it makes the turning and drilling of small diameters so much more satisfactory.

A two-speed countershaft is usually not difficult to arrange for.

After removing the mandrel from the headstock, the necessary balancing is easily carried out by rolling the mandrel, with the pulley in position, on two horizontal knife edges and drilling away material from the interior of the pulley on the heavy side until the static balance is correct.

A better result will be obtained if the pulley and the large gear wheel are balanced separately, as the whole assembly is then more likely to be in dynamic balance.

The edges to two 12-in. steel rules make suitable straight edges, and with a little care in levelling, supports can be contrived by fitting the rules into sawcuts made in wood blocks.

Alternatively, if a really large vice is available, the rules can be held in the jaws with suitable packing to bring them the correct width apart to suit the mandrel bearings.

It is surprising how sweetly the lathe runs on top speed after carrying out this simple correction.

Yours faithfully,

Berkhamsted. JOHN LATTA.

Model Electric Traction

DEAR SIR,—H.G.H., in his comments on Model Electric Traction in a recent issue of THE MODEL ENGINEER takes a step in the right direction for many of us who have hitherto had to confine our traction interest to observation of the real thing. Several of his comments, however, suggest unfamiliarity with modern practice, so I add a few more comments of a clarifying nature.

Rheostatic braking is not customary in electric railways, though, in one form or another, it is fitted to most tramcars (the modelling of which, as Mr. R. Elliot has shown, is one branch of model electric traction). His reference to thermostatic temperature control should be amplified; for what is it used in electric traction? Armature-on-axle motors are very rare nowadays on full-size equipments; one stage of reduction gearing is usual except perhaps on large a.c. locomotives.

The power required from an electric model could be obtained from simple measurements of drawbar pull required and speed. Elaborate experiments, except for comparative purposes, are unnecessary.

Series-parallel rheostatic control is used for *starting* electric trains, and results in less waste of power in the resistances than would straight rheostatic control. The resistances are *not* used for speed control *as such*; there are only two *running* speeds, the non-rheostatic ones of "full series" and "full parallel." Additional higher-speed running speeds may be obtained by field weakening, another resistance in parallel with the motor field passing some of the current around the motor field, hence weakening it.

The Electric Railway Society, of which a surprisingly large number of members is seriously interested in the technicalities of electric traction, is hoping to start a model section; H.G.H. and others might like to join it and help to get things going.

Yours faithfully,

B. JOHN PRIGMORE, M.A.,
Hon. Asst. Sec. (Technical), The Electric
London, N.W.2. Railway Society.

Plated Hull for a Model Steamer

DEAR SIR,—A visit to the MODEL ENGINEER Exhibition has fired me with an ambition to build a $\frac{1}{4}$ in. to the foot scale model of the S.S. *Ferranti*, which you may know as one of the London Power Company's up-river steamers.

This being my first attempt at a scale model I would appreciate some advice, and to this end would like to get into touch with some one who has successfully completed a plated hull. Short of writing to every club in Great Britain, there seems to be no establishing such a contact except through the good offices of your journal.

Apropos of my ambition as above, the chief engineer is nibbling at the idea of building the main engines and auxiliaries in the same scale. Whether he takes the bait I am extending in the shape of blue prints from the builders, remains to be seen, but this 'ere vessel is going to be built ready to accommodate the works, should they materialise.

So if any model shipbuilder would like to take an enthusiastic amateur under a guiding wing I would be grateful to him.

Yours faithfully,

JAMES MACRAE,
S.S. *Ferranti*. *Chief Officer*.

Checking High Rotor Speeds

DEAR SIR,—At the conclusion of the article on "Brake Horse Power," by J.W.H., in the October 3rd issue of THE MODEL ENGINEER, the author asks if there is any more appropriate method of checking high rotor speeds without applying a resolution counter. I would like to mention that the stroboscopic method does not require any mechanical connection with the rotor whose speed is being checked and consequently does not absorb any power from the power unit, its accuracy depends on the ability of the operator to keep the rotor of the instrument revolving at a speed which makes a mark on the rotor under test appear to remain stationary, a tachometer mechanically connected to the instrument rotor gives its speed, which is either the same or a multiple of the speed of the power unit, depending on the design of the instrument rotor, which takes the form of a slotted drum through which the moving object is viewed.

Yours faithfully,

Shotton. FRANK E. MILLS.

"Archibald Russell"

DEAR SIR,—I think Mr. Fairweather has made an error in the model of the "Archibald Russell" shown in September 26th issue, or in the text concerning the flags.

The four flags, square flag "H" uppermost would be the International Signal letters of the ship, not of her owners. Being Finnish-owned since 1934 when the International Code was revised I believe I am correct in saying the signal letters of all that country's ships start with "H."

I believe there is also a mistake in the letter "C," although the photograph is indistinct. Letter "C" since 1934 is a square flag of blue, white, red, white, blue stripes all the same width. The illustration looks like "D," yellow, blue, yellow horizontal stripes, although the blue should be wider than the two yellows.

If Mr. Fairweather is correct in his statement that H, C, B, F, are the house flags of the original owners, the letters "C" and "F" should be pennants (pre 1934 code), "C" being a white pennant with a red disc, and "F" a red pennant with a white St. George's Cross.

I know little about the ship, but having some knowledge of the International Code, I thought I would mention this point.

Yours truly,
D. S. ANTHES, M.B.E.,
Chairman, Sheffield Ship Model Society.

Boiler Data Required

DEAR SIR,—I wonder whether your readers could help with advice over the matter of a boiler which I offered to make for a friend who is making up a set of Stuart Turner's triple expansion marine engine castings, H.P. cylinder $\frac{3}{4}$ in., I.P. $1\frac{1}{4}$ in., L.P. $1\frac{3}{4}$ in. I rashly offered to make a Yarrow type boiler to steam it, but I have no data as to how much steam this type of engine requires.

Off hand I would be inclined to make the steam drum $2\frac{1}{2}$ in. or 3 in., with $1\frac{1}{2}$-in. mud-drums, and $\frac{3}{8}$-in. water-tubes, the length to be about 8 in. and the firing some form of blow lamp giving a diffused flame.

I feel sure that some reader will be kind enough to come forward and give his experience. I should add that I am aiming at 125 lb./sq. in. working pressure.

Yours faithfully,
W. Felton. D. R. RICHARDS.

Clubs

The Society of Model and Experimental Engineers

The next meeting to be held at 39, Victoria Street, Westminster, S.W.1, will be on Saturday, November 9th, at 2.30 p.m. This advance notice is given to enable members to prepare some questions likely to extend the ability of the "Brains" to answer. Such questions, which are to be of a technical nature, should be handed to the Chairman or Secretary in advance of the meeting in time for them to be examined and the "Brains Team" to be appointed in accordance with the nature of the questions to be set. Needless to add, the team will have no prior notice of such questions.

Secretary: J. J. PACEY, 69, Chandos Avenue, Whetstone, N.20.

Newport (Mon.) and District Society of Model Engineers

A very successful first meeting, held on October 10th, launched this new society upon its career. Future meetings will be held on the second and fourth Thursdays of each month, at 7.30 p.m., in the Toc H Rooms, Skinner Street, Newport. Our next meeting will be on Thursday, November 14th. Further particulars may be had from the Hon. Secretary, S. M. HALL, 102, Fields Park Road, Newport, Mon.

Romford Model Engineering Club

Considerable progress has been made with the development of the new workshop, many of the newer members having co-operated with the older ones under the capable direction of Mr. L. Chilver, who, with Mr. Chapman, has almost lived on the job. These two gentlemen, ably assisted by other members, have also been primarily responsible for the considerable progress made with the construction of the new all-steel track. The following meetings have been fixed for November: Thursday 7th, Competition Night, 8 p.m.; Thursday 14th, Annual Dinner—all applications for tickets should reach the Secretary by November 1st; Thursday 21st, at 8 p.m., "Train Control," by A. R. Dunbar; Saturday 30th, afternoon visit to Control Room and Repair Shops at Stratford—particulars later. All Thursday meetings are held at the Red Triangle Club (late Masonic Hall), Western Road, Romford, from 8 p.m. until 10 p.m. Further particulars from FRANK E. MARKHAM, Hon. Secretary, 38, Kent Drive, Hornchurch. Tel. 3756.

The Tyneside Society of Model and Experimental Engineers

The programme of the above Society for November is:—Saturday, November 9th, 2.45 p.m., at the Workshop. Feature programme, "How its done and how to do it," by the Workshop Section. Wednesday, November 20th, 7.30 p.m., "Toys for the Kiddies." Members are asked to bring any home-made toys, mechanical or otherwise, to the workshop for this meeting.

Hon. Secretary: S. G. JONES, 56, Moor Crescent, Gosforth, Newcastle-upon-Tyne.

Mancunian Model Engineering Society

Visitors and prospective members are coming along to our meetings on Friday evenings at 8.0 p.m., at the Girls' Institute, Mill Street, Ancoats, and it is our aim to encourage them to do so and spread the news of our activities, amongst their model engineering friends, including those who

yearn and burn with the urge to create, but who dread to take the initial plunge. Welcome to our happy band.

Hon. Secretary: J. MEADOWS, 90, Bark Street, Clayton, Manchester 11.

York City and District Society of Model Engineers

The next meeting will be held on November 2nd, at 7.0 p.m., in No. 11 Room, Co-operative Hall, Railway Street, York. Bring along your suggestions for discussions, talks, etc.

Hon. Secretary: WM. SHEARMAN, 28, Terry Street, York.

Burnley and District Model Engineer Society

The next meeting will be held at the Church Institute, Manchester Road, Burnley, on Friday, November 1st, at 7.30 p.m.

Joint Hon. Secs.: C. BATEY, 36, Mosely Road, Burnley; and J. D. MEE, 2, Windsor Avenue, Church, near Accrington.

Orpington Model Engineering Society

The above Society has now re-commenced its meetings at Charterhouse Road School, Orpington. These meetings are on alternate Wednesdays at 7.30 p.m., and commenced on Wednesday, October 9th.

The Society is now nearing the end of its first year, during which membership has increased steadily, and now all look forward to a vigorous new session.

Hon. Secretary: W. WHITING, 127, Repton Road, Orpington.

Worcester Model Engineering Society

At our first ordinary meeting held recently, the draft rules for the Society were approved by the members, and the officers for the ensuing year were duly elected.

Future meetings will be held on the first Monday and the third Thursday in each month at our headquarters at The Bridge Inn.

Hon. Secretary: F. L. FUDGER, 23, Camp Hill Road, Battenhall, Worcester.

Whitefield Model and Engineering Society

On Friday, November 1st, Mr. Priestly will give a lecture on the History of the Lancashire and Yorkshire Railway, illustrated by means of an epideiscope.

Meetings are held fortnightly on Fridays, at 7.30 p.m.

Hon. Secreary: A. STEVENSON, 2, Newlands Drive, Prestwich.

Kimberley and District Model Engineers Society

There was an enthusiastic meeting of model engineers at the Horse and Groom, Kimberley, Nottingham, on October 10th, when it was unanimously agreed to form what will henceforth be known as the Kimberley and District Model Engineers Society.

Officers elected were: Chairman, Mr. A. Smithson; Vice-Chairman, Mr. A. Green; Secretary, Mr. W. T. Pedley; and Treasurer, Mr. B. Rawdin.

Already, the membership embraces model engineers from places as far apart as Langley Mill and Cinderhill, and it is anticipated that once in working order its success is assured.

All model makers in the district are invited to become members, the fee for which is only one shilling per meeting, which will be held on the first Wednesday of each month.

Hon. Secretary: T. W. PELLEY, 14, Edgwood Road, Kimberley, Nottingham.

Kodak Society of Experimental Engineers and Craftsmen

Recently, by courtesy of the G.W.R., a visit was made to the Old Oak Common Locomotive Depot, which is the largest not only on the system but also in the London area.

We were first shown round the factory where extensive repairs (such as remetalling axle boxes, replacing boiler tubes, re-turning wheel tyres, etc.), are carried out. Various engines in different stages of repair were closely inspected, including one which had shed a gudgeon pin and, in consequence, distorted one of the connecting-rods.

We next visited the main shed, which contains four electrically operated turntables. We then went into the open and inspected the individual axle-load weighing machine.

Locomotives in various stages of servicing then claimed our attention. Some were being re-coaled, others were having the smokeboxes and fireboxes cleaned out. Finally, we inspected the Ransomes and Rapier Steam Breakdown Crane, which can lift a maximum load of 45 tons at a radius of 15 feet. The visit, which lasted about two hours, proved to be most interesting and instructive, especially to those who have model steam locomotives under construction.

Bristol Model Power Boat Club

The Bristol Model Power Boat Club began its activities at Eastville Park Lake on Sunday morning, October 6th.

Mr. Noble made one excellent run of ten laps in 60 sec., and Mr. Kerswell's boat, which has a new engine (four-stroke poppet valve), showed good promise for the first time out.

The club having lost over half its members during the war, hopes to attract new recruits, of which we feel sure there must be some in the Bristol area.

Hon. Secretary and Treasurer: A. E. KERSWELL, 144, Burchells Green Road, Kingswood, Bristol 5. Tel. No. 73395.

NOTICES

The Editor invites correspondence and original contributions on all small power engineering and electrical subjects, which should be addressed to him at 23, Great Queen Street, London, W.C.2. Matter intended for publication should be clearly written, and should invariably bear the sender's name and address.

Readers desiring to see the Editor personally can only do so by making an appointment in advance.

All correspondence relating to sales of the paper and books to be addressed to THE SALES MANAGER, Percival Marshall and Co. Ltd., 23, Great Queen Street, London, W.C.2.

Correspondence relating to display advertisements to be addressed to THE ADVERTISEMENT MANAGER, "The Model Engineer," 23, Great Queen Street, London, W.C.2.

"THE MODEL ENGINEER"

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Buck and Ryan's Department for Lathes, Drilling Machines, Grinders, Electric Tools, Chucks, Surface Plates, Lathe Accessories and Tools.—310-312, Euston Road, London, N.W.1. Telephone: EUSton 4661. Hours of Business: 8.30 to 5.0 p.m., Monday to Friday; Saturday, 1.0 p.m.

Split Chucks for Watchmakers' Lathes, 6 mm., 6½ mm., and 8 mm., at 7s. each, postage 6d.—JOHN MORRIS, 64, Clerkenwell Road, London, E.C.1.

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Target Gas Blowpipes from stock, 2s. 6d., plus postage 3d.—GARNERS, Sheffield Road, Barnsley.

3½" Myford ML4 Lathe, new last May. Standard accessories, 230/1/50 motor, chuck, vertical slide, improvements; ⅝" Bench Drill, 2 speed, Jacob chuck, F. and L. countershaft, no motor. Lot £50.—81, Highdown, Worcester Park, Surrey.

Drummond 3½", treadle and stand, in perfect order, £10; ¼ h.p. Higgs, 230 volt, single phase motor, £5.—BOWES, "The Willows," West Row, Bury St. Edmunds.

Sale, 3" B.G.S.C. Lathe, compound slide rest, 4" 4-jaw Crown chuck, faceplate, driver plate, change wheels, centres, 3 cone pulley, oil drip feed. Nice lathe, £26. Carriage and packing extra.—HUTCHINSON, 8, Clinton Terrace, Barnstaple, Devon.

Post-war 3½" Drummond-Myford Type "M" Lathe, complete with in-built countershaft, stand, ½ h.p. Motor (230/1/50), reversing switch, adjustable light, swinging micrometer stand, lead-screw tumbler reverse, Burnerd 3- and 4-jaw chucks, 2 drill chucks, fixed and travelling steadies, faceplate, driver plate, spare back-plates, tool holders, boring and parting tools, threading indicator, bed guard, and all accessories, including suds pump system with piping, filters, regulator valve and flexible nozzle. Many other extras. The whole machine has been hand fitted by fully skilled engineer and is in perfect condition, £118.—47, Marksbury Avenue, Kew, Surrey.

For Sale, 4" Drummond with stand, foot motor, 4" chuck, sets 3-jaw, and faceplate. Best offer to—R. WARR, 3, Glebe Place, Leamington.

3½" Motorised Myford Lathe, bench model, Cushman and Whitton chucks, etc., in very first-class condition, £40.—DOGGETT, 23, Porchester Road, Newbury, Berks.

Pools' Special Horizontal Bench Miller, new and unused, £25; A.C. ¼ h.p. 230/1/50 Motor, £7; 6 only, 10" dia. 1½ scale Drivers, £4/5 6 only, 9½" dia., £3.—BEESON, "Wentworth," Hangersley, Ringwood, Hants.

Lathe Wanted, 3" to 3½" B.G.S.C., with or without accessories. Particulars to—J. DIXON, Broseley, Shropshire.

For Sale, Myford Lathe, chuck, accessories, motorised, £30. Offers.—JENKINS, 7, Burlington Road, Slough.

Milling Machine, motorised, table 15" × 4½", mounted on angle iron stand, with turnbucke adjustment to countershaft, £30, carriage extra, or near offer.—G. A. HOPE, 80, Bankfield Road, Liverpool 13.

Collets for No. 1 Morse mandrels, 1/8", 5/32", 3/16", with drawbar, 12s. 6d. set; also 1/16", 3/32", 7/32", ¼", at 4s. each. "Superb article" (customer). Limited number. State mandrel length. Postage 1s.—R.H., 80, Ridgeview Road, London, N.20.

Modern Lathe, 3½" centre × 18", 2" dia. front bearing, hollow spindle 21/32" dia. stay, 3" dia. shifting tailstock, 2 special cross slides, one with parting tool box at back, 2 self-centring chucks, 3" dia. and 4" dia., 6" dia. 4-dog chuck, 6" dia. slotted faceplate, ⅝" dia. lead screw, 8 t.p.i., with wheels, ¼ h.p. motor, 3 cone ½" vee drive. Masses of turning and boring tools. All built as one unit. As new. Offers £50 or over.—Box No. 4174, Edinburgh, MODEL ENGINEER Offices.

For Sale, "Hielan' Lassie" Parts, Main Frames, Buffer and Drag Beams, Pump Eccentrics, Bogie, Crank and Straight Axles, Trailing Cradle (nearly finished), Steel for connecting rods. All parts built from steel. Quantity 5-B.A. Set and Hex. Screws and Nuts; ¼ Angle Brass. Best offers.—R. HEMMINGS, 29, Deansway, Chippenham, Wilts.

Machinery. American Toolworks 9" Gap Bed Lathe, £95; Denbigh & Rockford Universal Millers, £90; Ward & Herbert all-geared Capstans, £145; Empire motorised Lathe, £195. Also Welding Plants, Bandsaws, Fly Presses, Compressors, Drills, Planers, Shapers. List free.—VICTA ENGINEERING Co., Maidenhead. 'Phone 50.

5" Barnes' B.G.S.C. Treadle Lathe, 1⅛" flat belt, Cushman chuck, driving plate, face and angle plates, fixed steady, tailstock chuck, full set centres, change wheels. Excellent condition, £40.—WATSON, "Northcot," Grove Avenue, Langdon Hills, Essex.

Look at the Price, 1s. 3d. gross; £1 for 20 gross; £8 per cwt., assorted Steel Screws, up to 2-B.A., ¾" to 1" long, cheese heads, csk. heads, hex. heads. New and bright, postage extra.—N. R. BARDWELL, 473, Abbeydale Road, Sheffield.

Wanted, Stand and Treadle, suit 3½" lathe, flat belt. Price and particulars to—STOKES, 18, Lawns Crescent, Grays.

4" Drummond Lathe, S.C., stand, treadle, as new.—126, Hampton Road, Twickenham, Middx.

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Atlas 5" Centre Lathe, in most excellent condition, £65; Atlas Lathe attachments, convert 5" Atlas without interference to lathe into first class ½ Capstan; Atlas 6-post turrets, long travel, indexing head, real precision job, £32 10s.; Atlas cut-off slide with back post, very robust, £8 10s.; Atlas Quick-acting Lever Collets, take standard Atlas Collets, £12 10s. All above attachments are adaptable, with slight modifications, for South Bend Lathe; D.C. Motors, a limited number of 1/6 to 1/3, 200/240.—TEDDINGTON ENGINEERING Co., 29, High Street, Teddington, Mddx. Kingston 1193/4.

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